AC Current Probe and Amplifier
PM9355

07M02A36

Instruction Manual/Gerätehandbuch/Notice d'emploi et d'entretien

9499 443 01602
801010

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860523 TEST AND MEASURING EQUIPMENT OSC 231

AC CURRENT PROBE AND AMPLIFIER PM9355/09

Already published: OSC 194
Subject : Special BNC connector

This information sheet must be used in combination with Instruction manual 9499 443 01602 and OSC 194.

The PM9355/09 is a standard AC current probe and amplifier PM9355 provided with a BNC male connector with automatic range indication possibility.
The attenuator range is selected by a resistor which is mounted in the holder of the BNC connector and - sets the input impedance to 50 Ohm
- sets the Y AMPL sensitivity to 20 mV/div.
- sets the sensitivity read out to 20 mV/div.

This initial settings can be changed again by turning the Y AMPL control knob.

Note: this automatic range indication is only effective at oscilloscopes with 50 Ohm input (PM3280-family or PM3290-family).

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841011 TEST AND MEASURING EQUIPMENT OSC194

AC CURRENT PROBE AND AMPLIFIER PM9355/03

Already published: -

Subject: New brown look

This information sheet must be used in combination with Instruction manual 9499 443 01602.

Starting the PM9355/03 the instrument is provided with the " new brown look". The following list includes the new ordering numbers for the brown mechanical parts.
For itemnumbers, refer to Fig. 9.1 and Fig. 9.2 (page 48) of the Instruction manual.

Item	Fig.	Order number	Description
1	9.1	5322 447 61009	Cover with slider
5	9.1	5322 447 61011	Housing complete
11	9.2	5322 447 61008	Amplifier cabinet
13	9.2	5322 456 90075	Textplate

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AC Current Probe and Amplifier
PM9355

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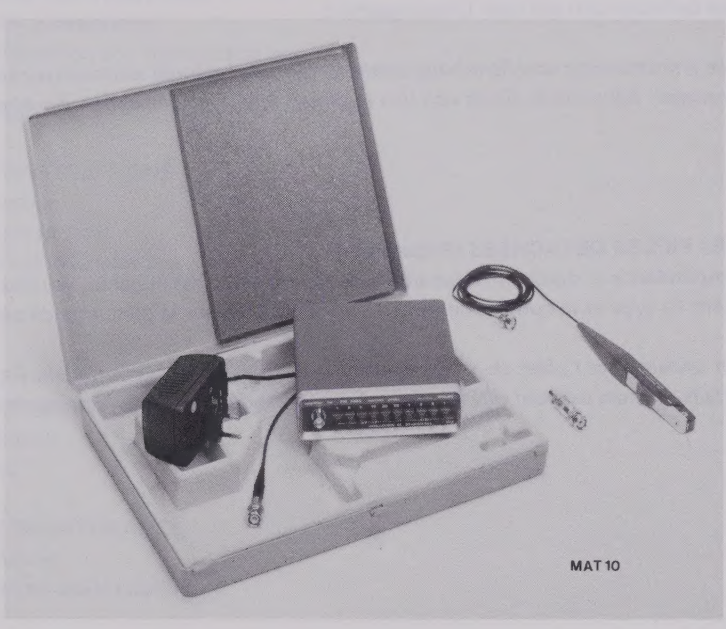

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IMPORTANT

In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

NOTE: *The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.*

WICHTIG

Bei Schriftwechsel über dieses Gerät wird gebeten, die genaue Typenbezeichnung und die Gerätenummer anzugeben. Diese befinden sich auf dem Leistungsschild.

BEMERKUNG: *Die Konstruktion und Schaltung dieses Geräts wird ständig weiterentwickelt und verbessert. Deswegen kann dieses Gerät von den in dieser Anleitung stehenden Angaben abweichen.*

IMPORTANT

RECHANGE DES PIECES DETACHEES (Réparation)
Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez TOUJOURS indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

REMARQUES: *Cet appareil est l'objet de développements et améliorations continuels. En conséquence, certains détails mineurs peuvent différer des informations données dans la présente notice d'emploi et d'entretien.*

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OPERATING MANUAL

1. INTRODUCTION

The type PM 9355 current probe is an alternating-current measuring device consisting of a clip-on current transformer and a frequency-compensated amplifier. The latter incorporates the measuring range switches. The current probe is intended for use with oscilloscopes having a 50-Ohm-input impedance. Oscilloscopes with a 1-MOhm-impedance may also be used, but only in combination with the supplied 50-Ohm-feedthrough termination.

Fig. 1.1. A.C. Current probe and amplifier

2. CHARACTERISTICS

The mains adaptor of the PM 9355 has been designed and tested in accordance with IEC Publication 348 for class II instruments and has been supplied in a safe condition. The present Instruction Manual contains information and warnings that shall be followed by the purchaser to ensure safe operation and to retain the instrument in a safe condition.

- This specification is valid after the instrument has warmed up for 30 minutes (reference temperature 23°C).
- Properties expressed in numerical values with tolerance stated, are guaranteed by the manufacturer. Numerical values without tolerances are typical and represent the characteristics of an average instrument.
- Inaccuracies (absolute or in %) relate to the indicated reference value.
  Unless otherwise stated, the specifications listed are valid for the type PM 9355 current probe (clip-on current transformer with amplifier) only, i.e. excluding the effects of the test oscilloscope.

2.1. ELECTRICAL CHARACTERISTICS

	Characteristics	*Specified performance*	*Additional info*
2.1.1.	Output load	50 Ohm	Oscilloscope to 20 mV/DIV and d.c. input coupling
	Output range	+or –6 DIV	
	Output offset	+ or –¼ DIV	Oscilloscope to 20 mV/DIV and d.c. input coupling
	Offset drift	negligible	Oscilloscope to 20 mV/DIV and d.c. input coupling
2.1.2.	Deflection coefficient	1 mA/DIV ...1 A/DIV in ten ranges (1-2-5 sequence)	Oscilloscope to 20 mV/DIV and d.c. input coupling
2.1.3.	Error limit	+ or –3%	
2.1.4.	Bandwidth	⩽ 12Hz to ⩾ 70MHz (–3 dB) ⩽ 12Hz to ⩾ 45MHz (–3 dB)	At 5 mA/DIV to 1 A/DIV At 1 mA/DIV and 2 mA/DIV
2.1.5.	Rise time (10% - 90%)	5 ns 8 ns	At 5 mA/DIV to 1 A/DIV Measured at a trace height of + or –4 DIV starting from the centre of the screen At 1 mA/DIV and 2 mA/DIV Measured at a trace height of + or –4 DIV starting from the centre of the screen
2.1.6.	Aberrations	⩽ + or –5%during the first 50 ns of step; ⩽ + or –1% thereafter. ⩽ + or –6%during the first 50 ns of step; ⩽ + or –1% thereafter.	At 1 mA/DIV to 20 mA/DIV At 50 mA/DIV to 1 A/DIV
2.1.7.	Tilt	⩽ 3%during the first 400 μs of step	
2.1.8.	Maximum current	12 A_{p-p}	f⩾ 300 Hz; for l.f. signals see Fig. 2.1.
2.1.9.	Maximum voltage	600 V(d.c. + a.c. peak)	When probe is closed
2.1.10.	Noise	⩽ 150 μA referred to input, or 0,02 DIV whichever is larger	Tangentially measured

2.1.11.	Capacitive load	0,5 to 2 pF	Depends on diameter of conductor
	Capacitive cross-talk	See Fig. 2.2.	
2.1.12.	Delay time	12 ns ± 1 ns	Current transformer without amplifier
		25 ns ± 2 ns	Current transformer together with amplifier
2.1.13.	Mains adaptor		Double insulated, Safety class II of IEC 348
	Line voltages	220V + 20% / −10%	
		100V + 30% / −10%	
	Line frequency	50–400Hz ± 10%	
	Power consumption	10VA max.	

2.2. MECHANICAL CHARACTERISTICS

Characteristics	*Specified quantity*			*Additional info*
Dimensions	L	W	H	
Probe body	173	18	28 mm	Maximum dimensions
Probe cable	1500		mm	
Supply cable	2000		mm	Maximum dimensions
Amplifier	155	142	42 mm	
Output cable	500		mm	Maximum dimensions
Case	260	340	62 mm	

2.3. ENVIRONMENTAL CHARACTERISTICS

NOTE:
The characteristics are valid only if the instrument is checked in accordance with the official checking procedure. Details on these procedures and failure criteria are supplied on request by the PHILIPS-organisation in your country, or by N.V. PHILIPS'GLOEILAMPENFABRIEKEN, TEST AND MEASURING DEPARTMENT, EINDHOVEN, THE NETHERLANDS.

	Characteristics	*Specified performance*	*Additional info*
2.3.1.	Ambient temperature	+5 °C ... +40°C	Rated range of use
		−10°C ... +55°C	Limit range of operation
		−40°C ... +70°C	Storage and transport
2.3.2.	Humidity	In accordance with IEC68Db	Non-operating
2.3.3.	Altitude	to 5000m	Operating within specs
		to 15000 m	Storage
2.3.4.	Vibration	In accordance with IEC68Fc	Operating
2.3.5.	Shock	In accordance with IEC68Eb	Non-operating

2.4. ACCESSORIES

2.4.1. Accessories supplied with the instrument

A 50-Ohm-feedthrough termination pad PM 9585
A hanger assembly.
An instruction manual.
An earth cable.

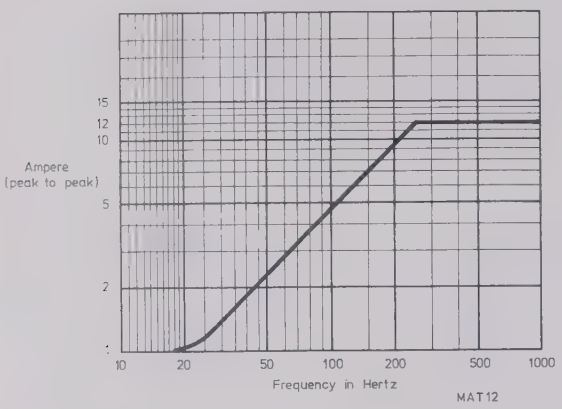


Fig. 2.1. Derating of max. current for l.f. signals

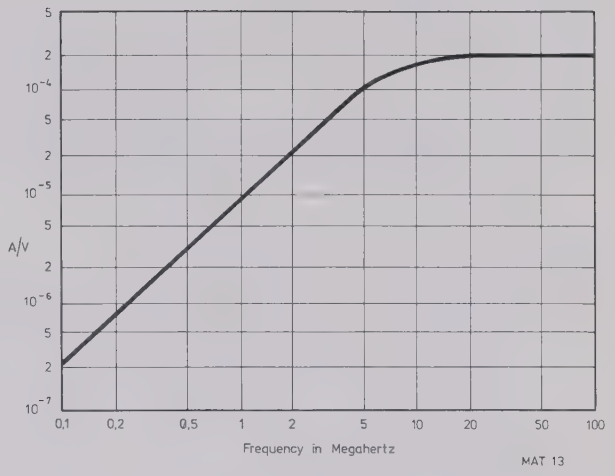


Fig. 2.2. Capacitive cross-talk

3. INSTALLATION INSTRUCTIONS

3.1. IMPORTANT SAFETY INSTRUCTIONS

Before connecting the instrument to the mains (line), visually check the cabinet controls and connectors etc. to ascertain whether any damage has occurred in transit. If any defects are apparent, do not connect the instrument to the mains (line).

CLAIMS: **In the event of obvious damage or shortages or if the safety of the instrument is suspect, a claim should be filed with the carrier immediately. A Philips Sales or Service organisation should also be notified in order to facilitate the repair of the instrument.**

The instrument must be disconnected from all voltage sources and any high points discharged before any maintenance or repair work is carried out. If adjustments or maintenance of the operating instrument with covers removed is inevitable, it must be carried out only by a skilled person who is aware of the hazards involved. In normal operation the double-insulated main adaptor obviates the need of a safety ground.

WARNING: **It must be borne in mind that in all measurements the frame ground of the current probe amplifier is raised to the same potential as that of the connector oscilloscope. Neither the frame ground of the current probe amplifier nor the frame ground of the connected oscilloscope shall be at live potential.**

EARTHING: **If the clip-on current transformer is clamped around a conductor which has a potential higher than 30V ac r.m.s. or 42,4V dc and ac peak, the earth screw ⏚ at the rear of the amplifier must be properly grounded.**

3.2. LOCAL MAINS (LINE) CONNECTION AND FUSE PROTECTION

Before connecting the instrument to the mains (line), make sure that it is set to the local mains (line) voltage. On delivery the instrument is set to 220V. If the instrument is to be used with 110V supply, the appropriate voltage should be selected by turning the switch on the rear of the mains (line) adaptor. When turning the adaptor, disconnect the instrument from the mains. The instrument is protected against overloads by means of a thermal fuse, which is located in the mains-adaptor transformer.

3.3. INSTALLATION

Connect the cable of the clip-on current transformer to the BNC input socket at the front of the current probe amplifier. Connect the output cable of the amplifier to the vertical input of the oscilloscope; if necessary, use the 50-Ohm-feed through termination pad.

3.4. MEASURING SET-UP

If you want to make a more permanent measuring set-up, the amplifier case may be fastened to the oscilloscope cabinet be means of the hanger assembly which is supplied with the probe.
The mounting procedure is as follows:

1. Remove the amplifier cabinet in accordance with section 7.3.
2. Drill at either side of the cabinet a 3,5mm dia hole, at a distance of 20,4mm from the bottom and at 58mm from the front of the cabinet (refer to fig. 3.1.1.).
3. Refit the cabinet and check that there is a 3mm threaded hole accessible through either newly drilled hole.
4. Place the amplifier at a convenient place on top of the oscilloscope. For convenience of operation, the front panel controls should extend beyond the oscilloscope front.
5. Mark the place of the amplifier and drill two 8mm dia holes, separated by 152 mm, in the top plate of oscilloscope. These holes must be drilled at such a place that they are vertically in line with the holes at either side of the amplifier (fig. 3.1.2.).
6. Place the amplifier between the holes.
7. Hook the thin end of the supplied brackets in the 8 mm dia holes (position of brackets as shown in fig. 3.1.3.) and screw the brackets to either side of the amplifier by means of the supplied screws and washers. The supplied screws are metric 3 mm and fit the 3mm dia threaded holes accessible through the newly drilled 3,5mm dia holes.

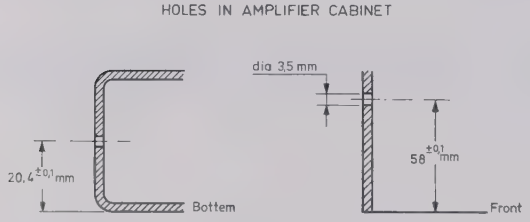


Fig. 3.1.1.

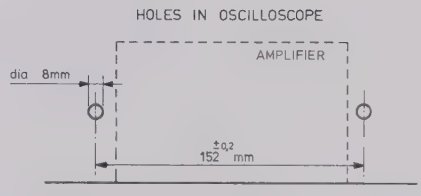


Fig. 3.1.2.

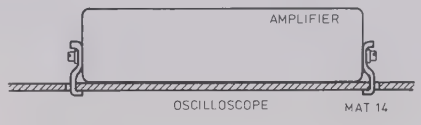


Fig. 3.1.3.

Fig. 3.1. Fitting the amplifier to the oscilloscope.

4. OPERATION INSTRUCTIONS

4.1. GENERAL INFORMATION

This section outlines the procedures and precautions necessary for operation. It indentifies and briefly describes the functions of the front and rear panel controls and indicators, and explains the practical aspects of operation to enable an operator to evaluate quickly the instrument's main functions.

Important
Make sure that the oscilloscope you intend to use with the current probe has a 50-Ohm-input impedance. For oscilloscopes with a high input impedance, insert the supplied 50-Ohm-feedthrough termination pad into the lead from the current probe amplifier to the oscilloscope. USE THE TERMINATION PAD ONLY FOR THE PROBE IT IS SUPPLIED WITH, SINCE THE AMPLIFIER HAS BEEN CALIBRATED WITH THIS PAD.

4.2. DIRECTION OF CURRENT FLOW

Conventional current (flowing from + to –) flowing in the direction of the arrow on the probe will cause an upward deflection on the c.r.t. screen. This applies only, of course, if the signal polarity has not been inverted by means of the NORM/INVERT control of the oscilloscope.

4.3. LOADING OF THE CIRCUIT UNDER TEST

Whenever possible, clamp the clip-on current transformer around the low-potential or earth end of a component lead. In this way, loading of critical circuits and display of noise and interference will be minimized.

4.4. PROBE SLIDER

The probe slider is used to open the clip-on transformer core in the probe tip and to close it around the conductor under test. This conductor then acts as the primary of the current transformer.

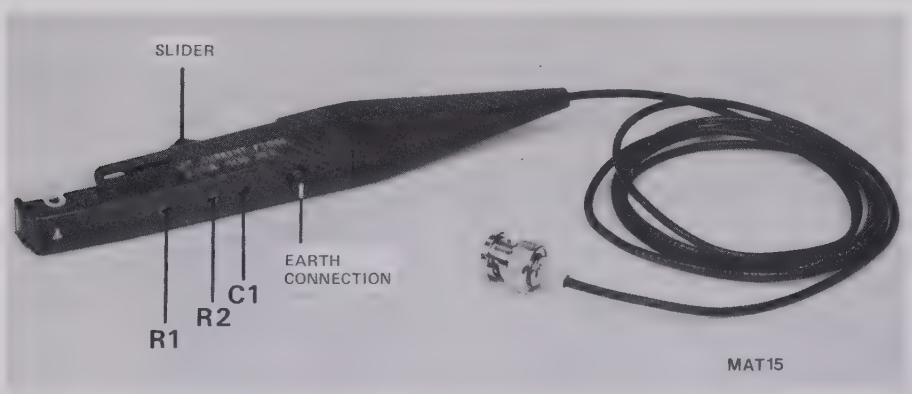


Fig. 4.1. Clip-on current transformer

Make sure that during the measurements the slider is pushed all the way foreward, the word ON visible, as this guarantees the maximum contact between the moveable and stationary part of the transformer core. If the slider has not been pushed all the way foreward, large l.f. errors may occur.
As an extra protection to the circuit under test, the screening around the transformer core is only connected to earth when the slider is in the foremost (ON) position. In this way, accidental short circuits to earth are prevented when the probe is clamped around the conductor under test.

4.5. INTERFERENCE

Do not clamp the current transformer around a conductor which is part of a current loop with a large area. This loop picks up interference which will be displayed together with the signal. If it is inevitable to measure in in a large loop, the order of magnitude of the interference may be obtained by leaving the probe around the conductor and switching off the test current. The signal which is then displayed, is the picked-up interference. It is also possible to determine the interference by a differential measurement. Clamp to this end the clip-on current transformer around both the foreward and return conductor at the same time.

4.6. HIGH CURRENTS

If high currents are measured, never disconnect the clip-on current transformer from the amplifier or from its termination when it is still clamped around the conductor under test. When the probe cable is not terminated in this condition, a very high voltage which is likely to damage the current transformer is produced in the secundary winding.

4.7. USING THE CLIP-ON CURRENT TRANSFORMER ONLY

The clip-on current transformer may be used without the amplifier on an oscilloscope with a 50-Ohm-input impedance or via the 50-Ohm-feedthrough termination pad. Bear in mind, however, that the transformation ratio is 99 : 1 for the probe only instead of 100 : 1, when the probe is used together with the amplifier. This means that for the probe only, the output signal is not 0,5V/A but 0,505V/A. The overall deflection coefficient may be found in this case by multiplying $\frac{99}{50}$ A/V by the deflection coefficient the oscilloscope is set to:

Example: Oscilloscope setting 1 mV/DIV; the overall deflection coefficient is then:

$\frac{99}{50}$ A/V X 1 mV/DIV = 1,98 mA/DIV

If desired, the oscilloscope's gain may be changed to make up a ratio of 100 : 1 Clamp to this end the probe around the CAL current loop of the oscilloscope and readjust the overall gain of the oscilloscope to obtain the required trace height.

4.8. USING THE CLIP-ON CURRENT TRANSFORMER TOGETHER WITH THE AMPLIFIER

In this case, the entire deflection coefficient is indicated on the push-button labels at the front of the amplifier. Bear in mind that these coefficients are only valid when the test oscilloscope has been set to a deflection coefficient of 20 mV/DIV.

Fig. 4.2. Amplifier.

4.9. INSERTION IMPEDANCE

The insertion impedance of the current probe is the equivalent circuit that is inserted into the current path when the clip-on current transformer is clamped around the conductor under test. The equivalent circuit is shown in fig. 4.3. In the flat part of the frequency characteristic, the insertion impedance is approximately

$$\frac{50\ \text{Ohm}}{99^2\ \text{turns}} \approx 5\ \text{mOhm}$$

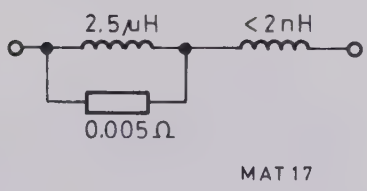


Fig. 4.3. Equivalent circuit forming the insertion impedance

4.10. MEASURING HINTS

4.10.1. Increasing the sensitivity

The current sensitivity may be increased by increasing the number of primary turns. Looping the conductor under test through the current transformer twice results in an increase of the secundary current by a factor of two, since the current ratio in a transformer is inversely proportional to the turns ratio.
However, bear in mind that the insertion impedance which comes in series with the circuit being measured varies as the square of the primary turns.
The sensitivity may also be increased by setting the oscilloscope's deflection coefficient to a lower value. If the coefficient is set to 10mV/DIV, the sensitivity for currents is increased by a factor of two.
A disadvantage, however, is the display of more noise.

4.10.2. Decreasing the sensitivity

In order to measure higher currents than the specified maximum current of $12A_{p\text{-}p}$, the current sensitivity of the probe may be decreased as follows. Interrupt the conductor the high current of which must be measured. Take two, three or more pieces of identical wire, cut them to approximately 10 cm and solder the wires together at both ends, in such a fashion that a conductor of two, three or more wires in parallel is obtained. Close the current path by bridging the interruption of the current path by means of the wire assembly. Clamp the clip-on current transformer around ONE of the wires of the assembly. If the assembly consists of two wires, the current through the probe will be half of the current through the conductor, one third of the current if the assembly consists of three wires, and so on.

5. PREVENTIVE MAINTENANCE

5.1. GENERAL INFORMATION

This instrument generally requires no maintenance, as the instrument has no components that are subject to wear. However, to ensure reliable and troublefree operation, the instrument should not be exposed to moisture, heat, corrosive elements or excessive dust.

5.2. CLEANING THE NEXTEL SUEDE COATING OF THE AMPLIFIER CABINET

WARNING: **The Nextel suède coating is ethanol-resistant, but is susceptible to methylated spirit, which will attack the surface (due to one of the de-naturing substances).**

The brigtht appearance of the amplifier cabinet, lacquered with Nextel suéde coating will deteriate after some time as the surface becomes solied. Cleaning with a cloth soaked in water, ethanol or a common household cleansing agent does not always restore this lustre and leaves dirt in the holes and the pores.

The 3M Company have developed a new cleansing pad (White Cleansing Pad, Catalogue No. 8440) which when soaked in water, ethanol or a common household cleansing agent will also penetrate holes and pores. This method is similar to that of abrasive cleaning pads but lacks their abrasive action.
Abrasive cleaning pads should not be used, otherwise surface scratches will result.

5.3. RECALIBRATION

To ensure accurate measurements, check the calibration of this instrument after each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. The checking & adjusting procedure can also be helpful in localizing certain troubles in the instrument.
In some cases, minor troubles may revealed and/or corrected by recalibration. Complete checking & adjusting instructions are given in the checking & adjusting chptr. 8.

BEDIENUNGSANLEITUNG

1. EINLEITUNG

Die PM 9355 Stromzange ist ein Wechselstrom-Messystem, welches aus einem aufsteckbaren Stromwandler und einem frequenzkompensierten Verstärker besteht. Letzterer enthält die Messbereichs-Dructasten. Die Stromzange ist für Oszilloskope mit einem 50 Ohm-Eingangswiderstand vorgesehen. Oszilloskope mit einem 1 MOhm Eingang können in Kombination mit dem mitgelieferten 50 Ohm Abschlusswiderstand benutzt werden.

Abb. 1.1. Wechselstrom-Zange und Verstärker

2. TECHNISCHE DATEN

Der Netzadapter von der PM 9355 ist gemäss IEC 348, Sicherheitsbestimmungen für Mess- und Regeleinrichtungen, gebaut und geprüft und hat das Werk in sicherheitstechnisch einwandfreiem Zustand verlassen. Um diesen Zustand zu erhalten und einen gefahrlosen Betrieb sicherzustellen, muss der Anwender die Hinweise und Warnvermerke beachten, die in vorliegender Anleitung enthalten sind.

- Diese Kenndaten gelten nach einer Anwärmzeit des Geräts von 30 Minuten (Bezugstemperatur 23°C).
- Zahlenwerte mit Toleranzangaben werden vom Hersteller garantiert. Zahlenwerte ohne Toleranzangaben sind Durchschnittswerte und dienen nur zur Information.
- Ungenauigkeiten (absolut oder in %) sind bezogen auf den angegebenen Bezugswert.

Wenn nichts anderes angegeben ist, gelten die folgenden Daten nur für die Stromzange mit dem Verstärker, d.h. ohne den Einfluss des Test-Oszilloskopes.

2.1. ELEKTRISCHE EIGENSCHAFTEN

	Benennung	*Spezifizierte Daten*	*Zusätzliche Informationen*
2.1.1.	Ausgangs Last	50 Ohm	
	Ausgangs Bereich	+ oder –6 Teile	Oszilloskop auf 20 mV/Teil und DC
	Ausgangs Offsett	+ oder –1/4 Teil	Kopplung eingestellt.
	Ausgangs Drift	zu vernachlässigen	
2.1.2.	Ablenkkoeffizient	1 mA/Teil ... 10 mA/Teil in zehn Bereichen (1-2-5 Abstufung)	Oszilloskop auf 20mV/Teil und DC Kopplung eingestellt.
2.1.3.	Fehlergrenzen	+ oder –3%	
2.1.4.	Bandbreite	⩽ 12 Hz ... ⩾ 70 MHz (–3 dB)	Bereich 5 mA/Teil ... 1 A/Teil
		⩽ 12 Hz ... ⩾ 45 MHz (–3 dB)	Bereich 1 mA/Teil und 2 mA/Teil.
2.1.5.	Anstiegzeit	5 ns	Bereich 5mA/TEIL .... 1mA/TEIL gemessen bei einer Ablenkung von ± 4 Teilen beginnend von der Bildschirmmitte.
		8 ns	Bereich 1 mA/Teil und 2 mA/Teil Bedingungen wie oben.
2.1.6.	Abweichungen	⩽ ± 5 % während der ersten 50 ns eines Sprungs; danach ⩽ ± 1%	Bereich 1 mA/Teil ... 20 mA/Teil
		⩽ ± 6%während der ersten 50 ns eines Sprungs; danach ⩽ ± 1%	Bereich 50 mA/Teil ... 1 A/Teil
2.1.7.	Dachschräge	⩽ 3% während der ersten 400 µs eines Sprungs	

2.1.8.	Max. Strom	$12A_{ss}$	$f \geqslant 300$ Hz, für niedrigere Frequenz siehe Fig. 2.1.
2.1.9.	Max. Spannung	600V (Gleichspannung + Wechselspannungs-Spitze)	Bei geschlossener Stromzange
2.1.10.	Störspannung	$\leqslant 150$ µA auf den Eingang bezogen, oder 0,02 Teile.	Tangential gemessen
2.1.11.	Kapazitive Last Kapazitives Übersprechen	0,5 ... 2 pF siehe Fig. 2.2.	Abhängig vom Leiterdurchmesser.
2.1.12.	Verzögerung	12 ns ± 1 ns	Stromzange ohne Verstärker
2.1.13.	Netzadapter Netzspannung Leistungsaufnahme	 220V + 20% /— 10% 100V + 30% /— 10% 45 ... 440 Hz 10 VA max.	Doppelt isoliert, gemäss IEC348 Sicherheitsbestimmungen der Schutzklasse II

2.2. MECHANISCHE DATEN

Benennung	*Spezifizierte Daten*				*Zusätzliche Informationen*
Abmessungen	Länge	Breite	Höhe		
Stromzange	173	18	28	mm	Maximal Abmessungen
Stromzangen Kabel	1500			mm	
Hilfsenergie Kabel	2000			mm	
Verstärker	155	142	42	mm	
Ausgangs Kabel	500			mm	
Transport Behälter	260	340	62	mm	

2.3. UMGEBUNGSBEDINGUNGEN

Bemerkung: Die angegeben Daten gelten nur dann, wenn das Gerät gemäss den offiziellen Prüfverfahren kontrolliert wurde. Einzelheiten, die dieses Verfahren und die Fehlergrenzenkriterien betreffen, können von der PHILIPS-Organisation ihres Landes oder von N.V. PHILIPS'GLOEILAMPEN-FABRIEKEN, TEST AND MEASURING DEPT., EINDHOVEN, HOLLAND angefordert werden.

	Benennung	*Spezifizierte Daten*	*Zusätzliche Informationen*
2.3.1.	Temperaturbereich	+ 5°C ... + 40°C	Spezifizierter Temperatur-bereich
		–10°C ... + 55°C	Betrieb
		–40°C ... + 70°C	Lagerung und Transport
2.3.2.	Feuchtigkeit	Entsprechend IEC 68 Db	Nich in Betrieb
2.3.3.	Höhe	bis 5.000 m	Betrieb innerhalb der Spezifikation
		bis 15.000 m	Lagerung
2.3.4.	Vibration	Entsprechend IEC 68 Fc	Betrieb
2.3.5.	Stoss	Entsprechend IEC 68 Eb	Nicht in Betrieb

2.4. ZUBEHÖR

2.4.1. Mitgeliefertes Zubehör

1 50 Ohm Abschlusswiderstand PM 9585
1 Satz Halteklammern
1 Bedienungsanleitung
1 Erdungs-Leitung

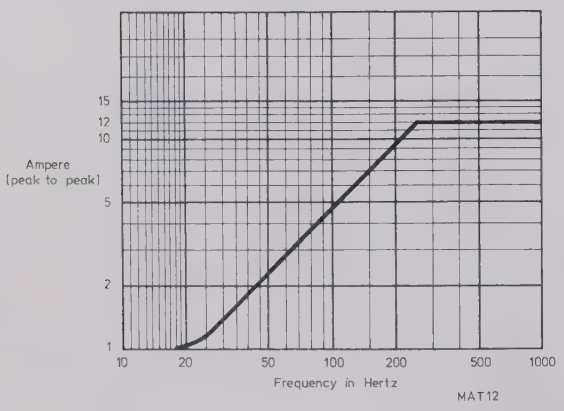


Fig. 2.1. Abnahme des maximalen Stromes für niederfrequente Signale

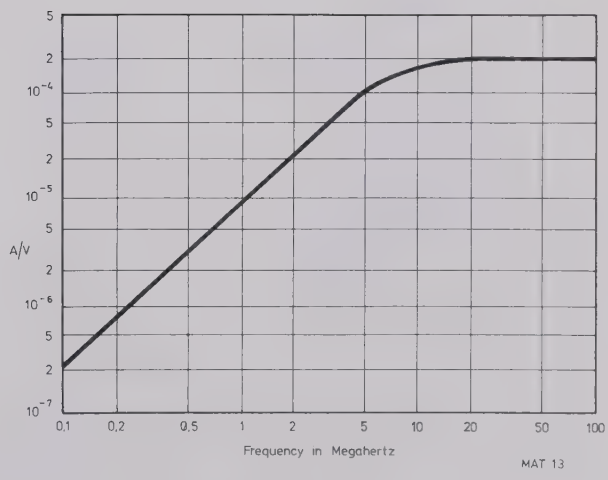


Fig. 2.2. Kapazitives Übersprechen

3. INSTALLIERUNGSANLEITUNGEN

3.1. WICHTIGE SICHERHEITSBEDINGUNGEN

Vor Anschluss des Gerät an des Netz ist eine Sichtkontrolle vorzunehmen, um eine mögliche Beschädigung des Geräts während des Transports feststellen zu können. Wenn irgendwelche Defekte wahrgenommen werden, darf das Gerät **nicht** an des Netz angeschlossen werden.

Reklamationen: **Im Falle offensichtlicher Beschädigungen oder Mängel oder wenn der sicherheitstechnische Zustand zweifelhaft erscheint, muss beim Überbringer sofort reklamiert werden. Eine Philips Verkaufs-oder Servicestelle muss ebenfalls verständigt werden um Reparatur des Geräts zu ermöglichen.**

Vor Wartungs-oder Reparaturarbeiten ist das Gerät von allen Stromquellen zu trennen und müssen alle Hochspannung führenden Teile entladen sein. Wenn danach eine Kalibrierung, Wartung, oder Reparatur am geöffneten Gerät unter Spannung unvermeidlich ist, so darf das nur durch eine Fachkraft, die damit verbundenen Gefahren kennt, geschehen. Normalbetrieb erübrigt die doppelte Isolierung der Netz adapter die Notwendigkeit einer Schutzerde.

Warnung: **Es ist zu beachten dass bei allen Messungen die Gehäuseerde der Stromzange Verstärker die gleiche Spannung wie der angeschlossene Oszilloskop erreicht. Weder die Gehäuseerde der Stromzange Verstärker noch die Gehäuseerde der angeschlossene Oszilloskop dürfen mit berührungsgefährlichen Spannungen verbunden werden.**

ERDUNG

Wenn die Stromzange über einen stromführenden Leiter geklemmt wird, die eine höhere Spannung führt als 30V Wechselspannung effectiv Wert oder 42,4V Gleichspannung und Wechselspannungs-Spitze, dann muss unbedingt der Erdanschluss ⏚ an der Hinterseite der Verstärker geerdet werden.

3.2. NETZANSCHLUSS UND SICHERUNG

Vor dem Einschalten ist das Gerät auf die örtliche Netzspannung einzustellen. Das Gerät wird ab Werk auf 220V eingestellt. Zur Umschaltung auf 110V wird der Schalter auf der Rückseite des Netzadapters betätigt, dabei muss unbedingt das Gerät vom Netz getrennt werden.
Der Netzadapter ist gegen Überlastung durch eine Temperatursicherung im Netztransformator geschützt.

3.3. INSTALLATION

Verbinde das Kabel der Stromzange mit dem BNC-Eingang auf der Frontseite des Verstärkers.
Verbinde das Ausgangskabel des Verstärkers mit der Eingangsbuchse des Oszilloskopes; erforderlichenfalls unter Verwendung des 50-Ohm-Abschlusswiderstandes.

3.4. VORBEREITUNGEN

Für einen permanenten Messaufbau kann das Verstärkergehäuse auch auf dem Oszilloskop mit Hilfe der beigefügten Halteklammern befestigt werden. Die erforderlichen Arbeitsgänge sind wie folgt:

1. Entferne das Verstärkergehäuse in Übereinstimmung mit Abschnitt 7.3.
2. Bohre auf jeder Seite des Gehäuses ein 3,5 mm Loch in einer Entfernung von 20,4 mm vom Gehäuseboden und 58 mm von der Frontseite (siehe Abb. 3.1.1.).
3. Montiere das Gehäuse und überprüfe, dass in jedem gebohrten Lock ein 3 mm Gewinde zugänglich ist.
4. Stelle den Verstärker an eine geeignete Stelle auf dem Oszilloskop. Zur Erleichterung der Bedienung sollte die Frontplatte etwas über die Oszilloskopfront vorstehen.
5. Kennzeichne die Position des Verstärkers und bohre zwei 8 mm Löcher 152 mm voneinander entfernt in die obere Abdeckplatte des Oszilloskops. Diese Löcher müssen so gebohrt werden, dass sie in einer vertikalen Linie mit Bohrungen auf den beiden Seiten des Verstärkers liegen (Abb. 3.1.2.).
6. Setze den Verstärker zwischen die Bohrungen.
7. Setze die dünnen Enden der mitgelieferten Halteklammern in die 8 mm Bohrungen (Pos. der Klammern wie in Abb. 3.1.3.) und schraube die Klammern mit Hilfe der mitgelieferten Schrauben und Unterlegscheiben an die Seite des Verstärkers. Die mitgelieferten metrischen 3 mm Schrauben passen in die Gewindelöcher, welche durch die neu gebohrten 3,5 mm Bohrungen zugänglich sind.

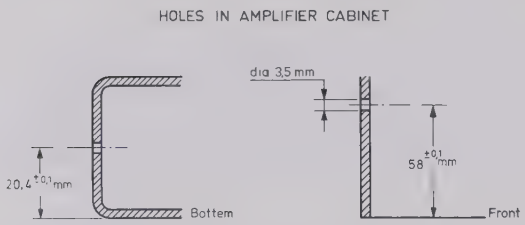


Abb. 3.1.1.

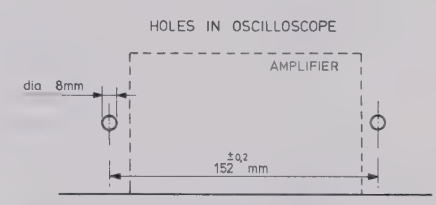


Abb. 3.1.2.

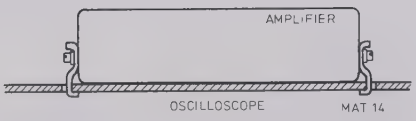


Abb. 3.1.3.

Abb. 3.1. Befestigung des Verstärkers auf dem Oszilloskop

4. BEDIENUNGSANLEITUNG

4.1. ALLGEMEINES

Dieser Abschnitt gibt einen Überblick der für die Inbetriebnahme des Geräts erforderlichen Handlungen und Vorsichtsmassregeln. Er beschreibt und erläutert in Kürze die Funktion der Bedienungsorgane auf Frontplatte und Rückwand sowie der Anzeigen. Ausserdem sind hier die praktischen Gesichtspunkte der Bedienung erklärt dies ermöglicht dem Bedienungsmann eine rasche Bewertung der Hauptfunktionen des Geräts.

WICHTIG

Überzeugen Sie sich, dass das Oszilloskop, mit dem Sie die Stromzange benutzen möchten, einen 50-Ohm-Eingangswiderstand hat. Für Oszilloskope mit einer höheren Eingangsimpedanz wird der mitgelieferte 50-Ohm-Abschlusswiderstand in die Leitung vom Stromzangenverstärker zum Oszilloskop eingefügt. Benutzen Sie den Anschlusswiderstand nur für die Stromzange, mit der er mitgeliefert wurde, da der Verstärker mit diesem Widerstand kalibriert wurde.

4.2. RICHTUNG DES STROMFLUSSES

Ein Strom, der in der Richtung des auf der Stromzange angegebenen Pfeiles fliesst, bewirkt eine Ablenkung des Elektronenstrahls auf der Bildröhre nach oben (Stromfluss von + nach −). Dies gilt natürlich nur, wenn die Signalpolarität am Oszilloskop nicht invertiert worden ist.

4.3. BELASTUNG DER ZU TESTENDEN SCHALTUNGEN

Wenn möglich, soll die Stromzange immer an einem erdpotentialnahen Leiter angeklemmt werden. Auf diese Weise wird die Belastung von kritischen Schaltungen und andere Störungen vermindert.

4.4. STROMZANGENSCHIEBER

Der Schieber wird benutzt, um die Stromzange zu öffnen und über den zu messenden Leiter schieben zu können. Dieser Leiter wirkt dann als Primärwindung eines Stromwandlertransformators.

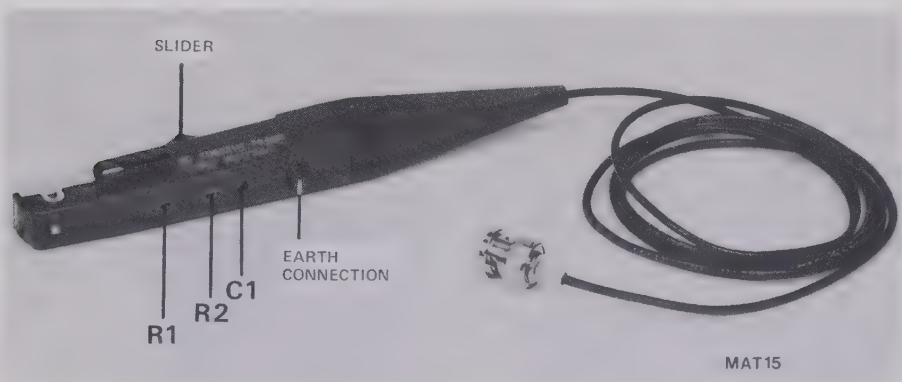


Abb. 4.1. Stromzange

Beachte, dass während der Messung der Schieber voll nach vorne geschoben ist und das Wort "on" sichtbar wird, da dieses einen max. Kontakt zwischen dem verschiebbaren und dem festen Teil des Transformators bewirkt.
Wenn der Schieber nicht voll bis vorne geschoben ist, können grössere n.f. Fehler auftreten. Als eine Extra-Sicherung für die zu testende Schaltung wird die Abschirmung um den Transformatorkern erst angeschlossen, wenn der Schieber in der vorderen Stellung (on) ist. Auf diese Weise werden unbeabsichtigte Erdschlüsse vermieden, während die Stromzange über den zu testenden Leiter geschoben wird.

4.5. STÖRUNGEN

Benutze die Stromzange nicht bei einem Leiter, welcher Teil einer Stromschleife mit einer grossen Fläche ist. Diese Schleife würde Störungen auffangen, die zusammen mit dem Signal dargestellt werden. Wenn es unvermeidlich ist, in einer Stromschleife zu messen, kann die Grösse der Störungen gemessen werden, indem man – während die Stromzange an ihrem Ort bleibt – die Testschaltung abschaltet. Das Signal, welches dann angezeigt wird, ist die aufgefangene Störung. Es ist ebenfalls möglich, die Störungen durch eine Differenzmessung zu bestimmen. Zu diesem Zweck wird die Hin- und Rückleitung gleichzeitug durch die Stromzange geführt.

4.6. HOHE STRÖME

Wenn Höhere Ströme gemessen werden, darf die Stromzange auf keinen Fall von dem Verstärker oder von seinen Anschlussklemmen abgeklemmt werden, solange die Stromzange auf dem zu testenden Leiter aufgeschoben ist. Wenn die Stromzange nicht mit einem richtigen Wert abgeschlossen ist, kann eine sehr hohe Spannung entstehen, die den Stromwandlertransformator zerstören kann.

4.7. BETRIEB DER STROMZANGE OHNE VERSTÄRKER

Die Stromzange kann auch ohne Verstärker an einem Oszilloskop mit einem 50-Ohm-Eingangswiderstand oder mit Hilfe des 50-Ohm-Durchgangswiderstandes benutzt werden. Zu beachten ist dabei, dass das Übersetzungsverhältnis 99:1 für die Stromzange alleine beträgt. Wenn der Verstärker eingesetzt ist, wird das Uberzetzungsverhältnis automatisch auf 100:1 eingestellt, das bedeutet, dass für die Stromzange alleine, das Ausgangssignal nicht 0,5 V/A sondern 0,505 V/A beträgt. Der Ablenkungskoeffizient kann in diesem Fall durch Multiplikation von $\frac{99}{50}$ A/V mit dem Ablenkungskoeffizenten des eingesetzten Oszilloskopes gefunden werden.

Beispiel: Das Oszilloskop ist auf 1mV/Teil eingestellt.
Der Ablenkkoeffizient beträgt dann: $\frac{99}{50}$ A/V x $1mV/_{DIV}$ = $1{,}98mA/_{DIV}$.

Falls erforderlich, kann die Oszilloskopverstärkung so eingestellt werden, dass sich ein Verhältnis von 100:1 ergibt. Zu diesem Zweck wird die Stromzange über die Kalibrier-Stromschleife des Oszilloskops geklemmt und die Verstärkung so eingestellt, dass die richtige Ablenkhöhe erreicht wird.

4.8. BETRIEB DER STROMZANGE ZUSAMMEN MIT DEM VERSTÄRKER

In diesem Fall sind die Ablenkkoeffizienten an den Drucktasten auf der Frontseite des Verstärkers angegeben. Zu beachten ist dabei, dass diese Koeffizienten nur gelten, wenn das Testoszilloskop auf einen Bereich von 20mV/Teil eingestellt ist.

Abb. 4.2. Verstärker

4.9. EINFÜGUNGSIMPEDANZ

Wenn die Stromzange über einen stromführenden Leiter geklemmt wird, fügt sie damit eine Impedanz in den Strompfad ein. Das Ersatzschaltbild ist gezeigt in Abb. 4.3.
Im flachen Teil der Frequenzcharakteristik ist die Impedanz ungefähr $\frac{50\ \text{Ohm}}{99^2\ \text{Windungen}} \approx 5\ \text{Ohm}$.

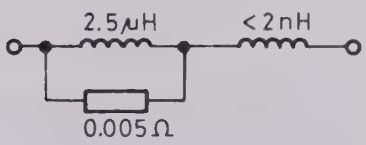


Abb. 4.3. Ersatzschaltbild der Impedanz

4.10. HINWEISE ZUR MESSUNG

4.10.1. Erhöhung der Empfindlichkeit

Die Stromempfindlichkeit kann durch Erhöhung der Primärwindungszahlen erhöht werden. Zweifaches Hindurchführen des Leiters durch den Stromwandler ergibt eine Empfindlichkeitserhöhung um den Faktor 2, da das übersetzungsverhältnis des Transformators umgekehrt proportional zu dem Windungsverhältnis ist. Dabei wird allerdings auch die Impedanz in Reihe mit der zu messenden Schaltung mit dem Quadrat der Primärwindungszahl erhöht. Die Empfindlichkeit kann ebenfalls durch Erhöhung der Ablenkempfindlichkeit des Oszilloskopes erhöht werden. Wenn der Ablenkkoeffizient auf 10mV/Teil eingestellt wird, ist die Empfindlichkeit der Strommessung ebenfalls um einen Faktor 2 erhöht. Ein Nachteil ist dabei, dass der Brummpegel ebenfalls um den Faktor 2 verstärkt wird.

4.10.2. Reduzierung der Empfindlichkeit

Um höhere Ströme als die spezifizierten 12 A zu messen, kann die Empfindlichkeit auf folgende Weise reduziert werden:

Trenne den Leiter auf, in dem der hohe Strom gemessen werden soll.
Nehme zwei, drei oder mehrere Stücke von gleichem Draht, schneide sie auf eine Länge von 10 cm und löte die Drahtenden an beiden Enden zusammen, so dass sich ein Leiter mit zwei, drei oder mehr parallelen Drähten ergibt. Dieser Leiter wird nun in den Strompfad eingefügt. Die Stromzange wird über einen Draht geschoben. Wenn diese Vorrichtung aus zwei Drähten besteht, dann beträgt der Strom durch die Stromzange nur 50% oder bei drei Drähten nur 1/3 des zu messenden Stromens, usw.

5. VORBEUGENDE WARTUNG

5.1. ALLGEMEINES

Das Gerät erfordert im allgemeinen keine Wartung, das es keine dem Verschleiss ausgesetzte Bauteile enthält. Um jedoch verlässlichen und fehlerlosen Betrieb zu gewährleisten ist das Gerät vor Feuchtigkeit, Hitze, Korrosion begünsigenden Einflüssen und übermässigem Staub zu schützen.

5.2. REINIGEN DER NEXTEL LACK OBERFLÄCHE

WARNUNG: **Der Nextel-Lack ist äthanolbeständig, jedoch nicht gegen Alkohol oder Methylalkohol (Brennspiritus) welcher die Oberfläche angrieft (durch eine der denaturierenden Substanzen).**

Das glänzende Aussehen der Nextel Lackierung des Gehäuses kann sich im Laufe der Zeit, als Folge von Verschmutzung, verschlechtern. Saubermachen mit einem in Wasser, Athanol oder einem der üblichen Haushaltswaschmittel getränktem Tuch kann nicht immer den Glanz wiederherstellen und lässt Schmutzreste in Löchern und Poren zurück.
Die 3M Company hat einen neuartigen Putzlappen entwickelt ("White Cleansing Pad", Katalognummer 8440) der getränkt in Wasser, Athanol oder in ein gewöhnliches Haushaltswaschmittel auch in Löcher und Poren eindringt.
Diese Methode ähnelt der von Scheuerlappen jedoch ohne deren kratzende Wirkung.
Scheuernde Lappen dürfen nicht verwendet werden, da sie die Oberfläche zerkratzen.

5.3. NEUKALIBRIERUNG

Erfahrungsgemäss ist zu erwarten dass, das Gerät innerhalb von 1000 Betriebsstunden oder 6 Monaten bei fallweisen Betrieb, innerhalb seine Spezifikationen arbeitet.
Ausserdem kann Ersetzen von Bauteilen eine Neukalibrierung der betreffenden Schaltung erforderlich machen.
Das Prüf und Einstell Verfahren kann auch bei der Ermittlung gewisser Fehler im Gerät behilflich sein.
In manchen Fällen werden geringfügige Fehler durch Neukalibrierung ermittelt und behoben. Vollständige Prüf- und Einstellanleitungen sind Abschnitt 8. "CHECKING AND ADJUSTING" zu entnehmen.

NOTICE D'EMPLOI

1. INTRODUCTION

La sonde de courant PM 9355 est une unité servant à mesurer du courant alternatif; elle consiste en un transformateur à mâchoires et un amplificateur compensé en fréquence, lequel est pourvu de selecteur de gamme de mesure.
La sonde de courant est destinée à l'emploi avec des oscilloscopes à impédance d'entrée de 50 ohm. Des oscilloscopes à impédance de 1M ohm peuvent également être utilisés, à condition d'y appliquer une charge de 50 ohm (livrée avec l'appareil).

Fig. 1.1. Sonde de courant alternatif et amplificateur

2. CARACTÉRISTIQUES

L'adaptateur secteur a été conçu conformément a la norme C.E.I. 348 pour les appareils de classe II. A la livraison, il répond aux règles de sécurite. La présente notice comporte des informations et les avertissements nécessaires à l'utilisateur afin d'assurer le fonctionnement de l'instrument dans les conditions de sécurité requises et de le maintenir dans un état conforme à la norme.

- Toutes les spécifications sont valables après un temps d'échauffement de 30 min . (température de référence 23°C).

- Seules les valeurs accompagnées d'une tolérance ou d'une limite sont garanties; les caractéristiques sans tolérance sont données à titre indicatif.

- Les précisions (absolues ou en %) se rapportent à la valeur de référence indiquée.

A moins qu'indiqué différement, les spécifications suivantes s'appliquent uniquement à la sonde de courant alternatif PM 9355 (transformateur à mâchoires et amplificateur), excluant entre autres les effets de l'oscilloscope de test.

2.1. CARACTÉRISTIQUES ÉLECTRIQUES

	Désignation	*Spécification*	*Information supplémentaire*
2.1.1.	Charge de sortie	50 ohm	oscilloscope sur 20 mV/DIV et couplage d'entrée continu
	Gamme de sortie	+ ou -6 DIV	
	Offset de sortie	+ ou - ¼ DIV	oscilloscope sur 20 mV/DIV et couplage d'entrée continu
	Dérive d'offset	négligeable	oscilloscope sur 20 mV/DIV et couplage d'entrée continu
2.1.2.	Coeffficent de dévation	1mA/DIV . . . 1 A/DIV en dix gammes (progression 1-2-5)	oscilloscope sur 20 mV/DIV et couplage d'entrée continu
2.1.3.	Précision	+ ou –3%	
2.1.4.	Bande passante	⩽ 12 Hz à ⩾ 70 MHz (–3dB)	De 5 mA/DIV à 1 A/DIV
		⩽ 12 Hz à ⩾ 45 MHz (–3dB)	A 1 mA/DIV et 2 mA/DIV
2.1.5.	Temps de montée (10% - 90%)	5 ns	De 5mA/DIV à 1A/DIV Mesurée à une hauteur de trace de + ou –4 DIV en partant du centre de l'écran
		8 ns	A 1 mA/DIV et 2 mA/DIV Mesurée à une hauteur de trace de + ou –4 DIV en partant du centre de l'écran
2.1.6.	Aberrations	⩽ + ou –5% pendant les premières 50 ns d'échelon; ⩽ + out –1% ensuite	De 1 mA/DIV à 20 mA/DIV
		⩽ + out –6% pendant les premières 50 ns d'échelon; ⩽ + ou –1% ensuite.	De 50 mA/DIV à 1 A/DIV
2.1.7.	Pente	⩽ 3% pendant les premières 400 μs d'échelon	

2.1.8.	Courant maximal	12 A_{cc}	f ⩾ 300 Hz; pour signaux à basse fréquence, voir Fig. 2.1.
2.1.9.	Tension maximale	600 V (continu + crête alternatif alternatif)	Lorque la sonde est fermée
2.1.10.	Bruit	⩽ 150 μA par rapport à l'entrée l'entrée ou 0,02 DIV, la plus grande valeur prime	Mesurée tangentiellement
2.1.11.	Charge capacitive	0,5 à 2 pF	Dépend du diamètre du conducteur
	Diaphonie capacitive	voir Fig. 2.2.	
2.1.12.	Temps de retard	12 ns ± 1 ns	Transformateur de courant sans amplificateur
		25 ns ± 2 ns	Transformateur de courant avec amplificateur
2.1.13.	Adaptateur secteur		Isolé double, conformément à la norme CEI 348 pour appareils de classe II
	Tensions secteur	220V + 20% / −10% 100V + 30% /−10%	
	Fréquence secteur	50-400 Hz ± 10%	
	Consommation de puissance	10VA max.	

2.2. CARACTÉRISTIQUES MÉCANIQUES

Désignation	*Spécification*			*Information supplémentaire*
Dimensions	Long	Large	Haut	
Corps de sonde	173	18	28 mm	Dimensions maximales
Câbles de sonde	1500		mm	
Condon d'alimentation	2000		mm	Dimensions maximales
Amplificateur	155	142	42 mm	
Câble de sortie	500		mm	Dimensions maximales
Coffret	260	340	62 mm	

2.3. CONDITIONS D'ENVIRONNEMENT

Les données d'environnement ne sont valables que si l'instrument est controlé conformément aux méthodes officielles. Des renseignements relatifs à ces méthodes et aux critères employés sont fournis sur demande par l'organisation PHILIPS de votre pays ou par le TEST AND MEASURING DEPARTMENT de la N.V. PHILIPS GLOEILAMPENFABRIEKEN a EINDHOVEN, PAYS-BAS.

	Désignation	*Spécification*	*Information supplémentaire*
2.3.1.	Température ambiante	+5°C à +40°C	Gamme de fonctionnement selon selon les spécifications
		−10°C à +55°C	Gamme limite de fonctionnement
		−40°C à +70°C	Gamme d'emmagasinage et de transport
2.3.2.	Himidité	Conforme à CEI 68Db	Hors service
2.3.3.	Altitude	jusqu'à 5000 m jusqu'à 15000 m	En service selon les spécifications Hors service
2.3.4.	Vibrations	Conforme à CEI 68Fc	En service
2.3.5.	Chocs	Conforme à CEI 68Eb	Hors service

2.4. ACCESSOIRES

2.4.1. Compris à la livraison

Une charge de 50 ohm PM 9585
Un dispositif de suspension
Une notice d'emploi
Un câble de terre

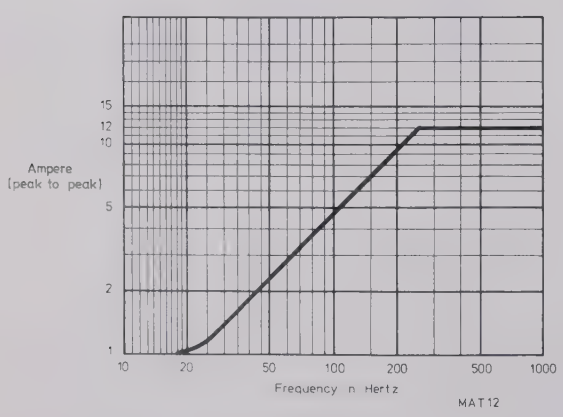


Fig. 2.1. Déréglage du courant maxi pour signaux à basse fréquence

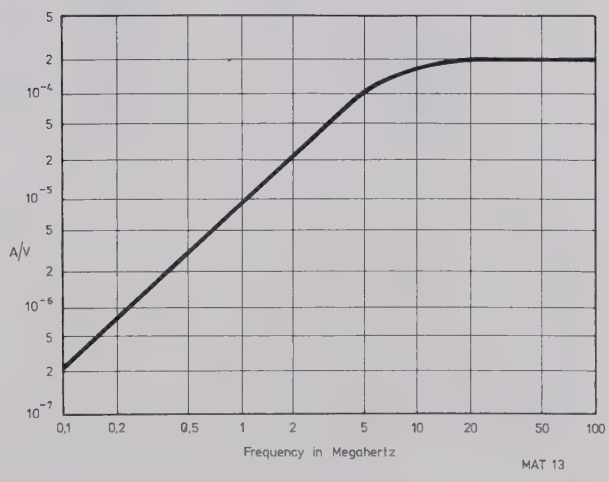


Fig. 2.2. Diaphonie capacitive

3. INSTRUCTIONS D'INSTALLATION

3.1. RÈGLEMENTS DE SÉCURITÉ IMPORTANT

Avant de brancher l'instrument sur le secteur, examiner le boîtier, les commandes, les connecteurs, etc. afin de s'assurer qu'il n'y a pas eu de dommages en cours de transport. En cas de défauts, ne pas brancher l'instrument.

RÉCLAMATIONS: **En cas de dommages ou d'insuffisances, ou si la sécurité de l'appareil est mise en doute, une réclamation doit être adressée directement au transporteur. De plus, il faudra également avertir une organisation de vente ou de service Philips afin de faciliter le procédé de réparations.**

Il faut déconnecter l'instrument de toute source de tension et décharger les points sous tension avant d'effectuer un travail d'entretien ou de réparation. Si les réglages ou l'entretien ne peuvent se faire que l'instrument en fonctionnement, couvercles déposés, le travail sera confié à un spécialiste, conscient des risques encourus. Il n'est pas nécessaire de mettre l'instrument à la terre en fonctionnement normal, si son adaptateur secteur est à double isolement.

ATTENTION: **Il ne faut pas oublier qu'en cours de fonctionnement, la masse du châssis d'amplificateur de la sonde de courant est portée du même potentiel que la connection de terre de l'oscilloscope connecté.**
Ni la masse du châssis d'amplificateur de la sonde de courant ni la masse du châssis d'oscilloscope connecté, ne doivent être connectés a des sources de tension dangereuses au toucher.

MISE À LA TERRE

Lorsque le transformateur est bouclé autour un conducteur qu'il porte une potentiel plus élevée que 30V alternatif, tension effectif ou 42,4V continu et crête alternatif, la connection de terre, ⏚ situé a l'arrière de l'amplificateur, doit connecté avec la terre.

3.2. ADAPTATION À LA TENSION SECTEUR ET FUSIBLE

Avant de brancher l'appareil au sectuer, s'assurer qu'il est réglé sur la tension secteur locale. A la livraison, l'appareil est réglé sur 220V. En cas d'alimentation 110V, la tension adéquate doit être sélectionnée à l'aide du commutateur situé à l'arrière de l'adaptateur secteur. Pendant cette manipulation, débrancher l'appareil du secteur.
L'appareil est protégé contre la surcharge à l'aide d'un fusible thermique monté dans le transformateur de l'adaptateur secteur.

3.3. INSTALLATION

Connecter le câble du transformateur à mâchoires à la borne d'entrée BNC, à l'avant de l'amplificateur
Connecter le câble de sortie de l'amplificateur à l'entrée verticale de l'oscilloscope; au besion, faire appel à la charge de 50 ohm.

3.4. DISPOSITION DE MESURE

Pour obtenir une disposition de mesure de caractère plus permanent, le boîtier d'amplificateur peut être fixé à l'oscilloscope à l'aide du dispositif de suspension livré avec la sonde.
Pour le montage procéder comme suit:

1. Déposer le coffret d'amplificateur conformément à la section 7.3.
2. Forer de chaque côté du coffret un trou de 3,5 mm ϕ , à 20,4 mm du fonc et 58 mm de l'avant du coffret (voir 3.1.1.).
3. Remettre le coffret en place et vérifier si un trou taraudé de 3 mm est accessible par chaque trou nouvellement foré.
4. Placer l'amplificateur en un endroit adéquat sur l'oscilloscope. Pour faciliter l'opération, les commandes de panneau avant doivent faire saillie par rapport à l'avant de l'oscilloscope.
5. Marquer la place de l'amplificateur et forer deux trous de 8 mm ϕ à 152 mm l'un de l'autre, dans la tôle supérieure de l'oscilloscope. Ces trous doivent être forés de telle sorte qu'ils soient en ligne verticale avec les trous de chaque côté de l'amplificateur (fig. 3.2.1.).
6. Placer l'amplificateur entre les trous.
7. Accrocher l'extrémité mince des étriers dans les trous de 8 mm ϕ (voir fig. 3.1.3.) et visser les étriers de chaque côté de l'amplificateur à l'aide des vis et rondelles fournies. Les vis fournies sont du type 3 mm métrique et s'adaptent dans les trous taraudés (3 mm) accessibles par les trous nouvellement forés (3,5 mm ϕ).

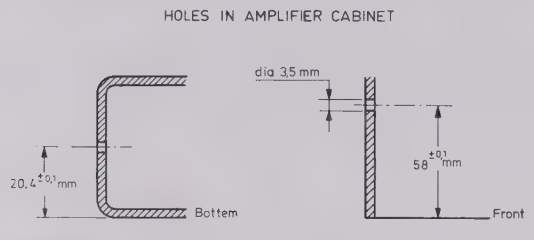


Fig. 3.1.1.

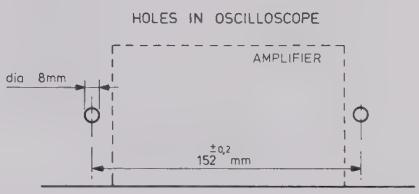


Fig. 3.1.2.

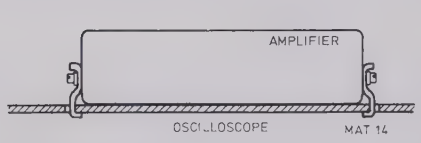


Fig. 3.1.3.

Fig. 3.1. Montage de l'amplificateur sur l'oscilloscope

4. INSTRUCTIONS D'UTILISATION

4.1. GÉNÉRALITÉS

La présente section décrit les travaux et précautions requises à l'utilisation. En outre, elle décrit sommairement les fonctions des commandes et des indicateurs et met en évidence les aspects pratiques du fonctionnement. De la sorte, un opérateur peut rapidement se familiariser avec les fonctions pricipales de l'instrument.

IMPORTANTE

S'assurer que l'oscilloscope que vous utilisez avec la sonde de courant présente une impédance d'entrée de 50 ohm. Pour des oscilloscopes à impédance d'entrée supérieure, monter la charge de 50 ohm dans le câble connectant l'amplificateur à l'oscilloscope.

Utiliser la charge uniquement pour la sonde avec laquelle elle est livrée, car l'amplificateur est étalonné avec cette charge.

4.2. SENS DU COURANT

Le courant conventionnel (+ vers —) dans le sens de la flèche marquée sur la sonde cause une déviation ascendante sur l'écran TRC. Ceci vaut seulement si la polarité du signal n'a pas été inversée à l'aide de la commande NORM/INVERT de l'oscilloscope.

4.3. CHARGE DU CIRCUIT TESTÉ

Si possible, accrocher le transformateur de courant à mâchoires côté faible potentiel ou terre d'un câble de composant. De cette façon, la charge de circuits critiques et l'affichage de bruit et d'interférence seront réduits.

4.4. COULISSE DE SONDE

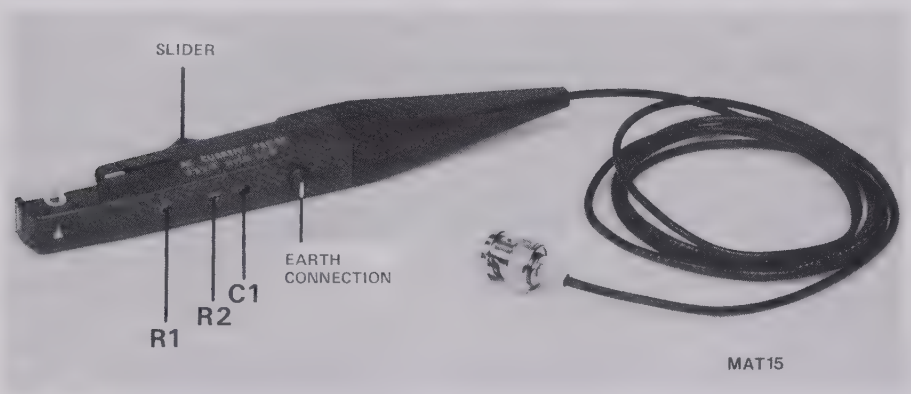


Fig. 4.1. Transformateur de courant à mâchoires.

La coulisse de sonde sert à ouvrir le transformateur à mâchoires dans l'embout de sonde et à le fermer autour du conducteur à mesurer. Ce conducteur sert alors de primaire au transformateur de courant.

S'assurer que pendant les mesures la coulisse soit repoussée entièrement vers l'avant. Le mot ON est visible, garantissant le contact parfait entre la partie mobile et la partie fixe du transformateur. Si la coulisse n'est pas bien repoussée, de grandes erreurs de basse fréquence sont possibles.

Une protections supplémentaire est prévue pour le circuit testé sous la forme d'un blindage entourant le noyau, le quel est mis à la terre dans le seul cas où la coulisse est en position avant (ON). De cette façon des courts-circuits à la terre sont évités lorsque la sonde est bouclée autour du conducteur testé.

4.5. INTERFERENCES

Ne pas boucler le transformateur autour d'un conducteur faisant partie d'une grande boucle de courant. Celle-ci capte des interférences, lesquelles seront affichées avec le signal.
La mesure d'une grande boucle est inévitable, la grandeur de l'interférence peut être déterminée en maintenant le conducteur dans la sonde et en éliminant le courant d'essais. Le signal affiché alors correspond à l'interférence captée. Il est également possible de déterminer l'interférence par une mesure différentielle. A cet effet boucler le transformateur à mâchoires sumiltanément autour du conducteur avant et du conducteur retour.

4.6. COURANTS FORTS

Pour la mesure de courants forts, ne jamais déconnecter le transformateur à mâchoires de l'amplificateur ou de sa charge alors qu'il est encore bouclé autour du conducteur testé. Si le câble de sonde n'est pas terminé dans ces conditions, une très haute tension apparaît dans l'enroulement secondaire, tension qui peut endommager dûment le transformateur de courant.

4.7. UTILISATION DU SEUL TRANSFORMATEUR À MÂCHOIRES

Le transformateur de courant à mâchoires peut être utilisé sans amplificateur sur un oscilloscope à impédance d'entrée de 50 ohm ou par la charge de 50 ohm. Cependant veiller à ce que le rapport de transformation soit de 99:1 pour la sonde seule au lieu de 100:1 au cas où la sonde est utilisé ensemble avec l'amplificateur. Ceci veut dire que pour la sonde seule, le signal de sortie n'est pas de 0,5V/A, mais de 0,505 V/A. Le coefficient de déviation total s'obtient dans ce cas en multipliant $\frac{99}{50}$ A/V par le coefficient de déviation sur lequel est réglé l'oscilloscope.

Exemple: réglage d'oscilloscope 1 mV/DIV; le coefficient de déviation total s'élève alors à:

$$\frac{99}{50} \text{A/V} \times 1 \text{mV/}_{\text{DIV}} = 1{,}98 \text{ mA/}_{\text{DIV}}.$$

Au besoin, le gain d'oscilloscope peut être modifié pour obtenir un taux de 100:1. A cet effet accrocher la sonde autour de la boucle de courant CAL de l'oscilloscope et rajuster le gain total de cet oscilloscope afin d'obtenir la hauteur de trace requise.

4.8. UTILISATION DU TRANSFORMATEUR À MÂCHOIRES COMBINÉ AVEC L'AMPLIFICATEUR

Dans ce cas le coefficient de déviation total est indique sur les boutons-poussoirs à l'avant de l'amplificateur. Veiller à ce que ces coefficients ne soient valables que lorsque l'oscilloscope d'essais est réglé sur un coefficient de déviation de 20 mV/DIV.

Fig. 4.2. Amplificateur

4.9. IMPÉDANCE D'INSERTION

L'impédance d'insertion de la sonde est le circuit équivalent formé dans le trajet de courant lorsque le transformateur à mâchoires est bouclé autour du conducteur testé. Ce circuit équivalent est illustré à la figure 4.3. La caractéristique de fréquence présente dans sa partie plane une impédance d'insertion d'environ:

$$\frac{50 \text{ ohm}}{99^2 \text{ tours}} \approx 5 \text{ m ohm}$$

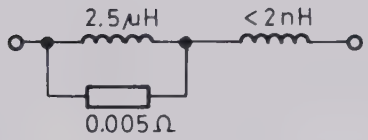


Fig. 4.3. Circuit équivalent d'impédance d'insertion

4.10. CONSEILS DE MESURE

4.10.1. Sensibilité accrue

La sensibilité de courant peut être accrue en augmentant le nombre de tours primaires. si l'on fait passer le conducteur testé deux fois par le transformateur de courant, le courant secondaire est accrû d'un facteur 2, car le taux de courant dans un transformateur est inversément proportionnel au rapport de transformation. Cependant veiller à ce que l'impédance d'insertion mis en série avec le circuit à mesurer varie comme carré des tours primaires. La sensibilité peut également être accrue en réglant le coefficient de dévaition de l'oscilloscope sur une valeur inférieure. Si le coefficient est réglé sur 10 mV/DIV, la sensibilité des courants est accrue d'un facteur 2. Le désavantage de cette méthode réside dans l'affichage d'un bruit supérieur.

4.10.2. Sensibilité décrue

Pour mesurer des courants supérieurs au courant maximal spécifié (12A crête-à-crête), la sensibilité de courant de la sonde peut être décrue comme suit. Interrompre le conducteur dont le courant fort doit être mesuré. Prendre deux, trois pièces ou plus d'un fil indentique, les couper à environ 10 cm et souder les fils ensemble aux deux extrémités, de sorte qu'un conducteur de deux, trois fils ou plus parallèles soit obtenu. Fermer le trajet de courant en sautant l'interruption à l'aide des fils. Boucler le transformateur à mâchoires autour d'UN des fils. Si deux fils sont utilisés, le courant par la sonde sera la moitié du courant par le conducteur. Dans le cas de trois fils, il sera le tiers de ce courant, et ainsi de suite.

5. ENTRETIEN PREVENTIF

5.1. GÉNÉRALITÉS

Le présent appareil ne requiert en principe aucune maintenance, car il ne contient pas de composants sujets à l'usure. Cependant, pour garantir le fonctionnement fiable et sans défaillances, l'appareil ne doit pas être exposé à l'humidité, le chaleur, des éléments corrosifs ou la poussière excessive.

5.2. NETTOYAGE DU REVÊTEMENT SUÈDE NEXTEL

ATTENTION: **Le revêtement suède NEXTEL résiste à l'éthanol, pas à l'alcool à brûler: la décomposition d'une des substances endommagerait le revêtement NEXTEL de façon irréparable.**

Au bout d'un certain temps, le revêtement suède NEXTEL perd de son éclat. Un nettoyage régulier de la surface à l'aide d'un chiffon humide (eau, éthanol ou autre détergent) ne donnera pas le résultat escompté. La surface frottée par un chiffon sero nettoyée, non les granulations et les griffes. 3M-COMPANY a développé une nouvelle méthode de nettoyage permettant le nettoyage des granulations. L'éponge n^{o} 8840 de 3M doit être trempée dans l'eau, l'éthanol ou un détergent courant. Il s'agit d'un chiffon ayant les mêmes propriétés que les éponges ou les chiffons abrasifs: il nettoie les surfaces et leur redonne l'éclat sans toutefois les griffer.

5.3. RÉ-ÉTALONNAGE

La pratique a prouvé que l'oscilloscope fonctionne dans les limites spécifiées pendant une période de 1000 heures de travail ou de 6 mois en cas d'usage irrégulier.
De plus, le remplacement de composants peut nécessiter un ré-étalonnage des circuits affectés. Les procédés de contrôle et d'ajustage peuvent également servir à détecter certaines fautes dans l'appareil.
Dans certains cas, des troubles mineurs peuvent être localisés et/ou corrigés par le ré-étalonnage. Les instructions complètes de contrôle et d'ajustage sont mentionnées au chapitre 8, "CHECKING AND ADJUSTING".

SERVICE MANUAL

6. CIRCUIT DESCRIPTION (See fig. 6.1. and fig. 9.4.)

6.1. CLIP-ON CURRENT TRANSFORMER

The current to be measured is inductively picket up by the primary of transformer A102. The current is transformed down by a factor of 99. The correction networks R1/L127, R/L126 and C1/R126 allow setting of optimum pulse response and rise time. Network R127/L128 and transformer L129 compensate for losses in the cable between current transformer and amplifier.

6.2. AMPLIFIER

The signal on output socket X2 of the clip-on current transformer, is applied to input socket X1 of the amplifier. Networks R201/C201 andR213/C202 in the input stage act as a termination for the cable between the current transformer and the amplifier, whereas networks R206/L201 and R207/L202 compensate for losses in this cable.

To achieve the different measuring ranges in 1-2-5 sequence, an input attenuator has been used in combination with different outputs of emitter follower V207 and gain-setting networks in the output stage.
Reed relays switch-in the various combinations as dictated by the push-button switches on the front panel.

The input attenuator comprises two low-ohmic voltage divider sections which are bypassed in certain measuring ranges. The section with resistor R212 gives an attenuation of 10 times and the one with R209 of 100 times. Trimmer capacitor C203 and potentiometer R211 make the sections independent of frequency and potentiometer R202 allows adjustment of the 20 mA/DIV range and onwards.

From the input attenuator, the signal is fed to the first amplifier stage which consists of transistors V203 and V204. This stage may be considered as an operational amplifier with a gain of approximately 3 times. This gain is determined by the ratio between feedback resistor R219 and resistor R207 in the input attenuator when the latter is in the "straight-through" position (1x).

The input resistance of the operational amplifier D201-A is low: the input is a virtual earth point. This is true because the input resistance is formed by the feedback resistance of R219 divided by the open-loop gain of transistor V203. As this gain is very high, the input resistance is only a few ohms. The input resistance must be equal in all positions of the input attenuator. In the 10x and 100x attenuated positions, the input resistance equals R202/R203/R204 = 5 Ohm. The input resistance in the "straight-through" position equals the input resistance of transistor V203. This resistance is adjusted to 5 Ohm by varying the open-loop gain of transistor V203 with the aid of preset potentiometer R222.

The three times amplified signal on the emitter of V204 is further amplified by this transistor. The signal at its collector is 20x the signal at the attenuator input.

The −3dB turn-over frequency of the clip-on current transformer at the lower side of the frequency-response curve is determined by the self-inductance and the internal resistance of the current transformer, and by the input resistance of the amplifier. This frequency is approximately 120 Hz. The specified lower frequency limit of the current transformer/amplifier combination, however, is 12 Hz. In order to obtain this lower frequency limit, the gain of transistor V204 is increased for frequencies below 120 Hz. The gain increase is proportional to the roll-off below 120 Hz of the clip-on current transformer's frequency response curve.

The gain increase is obtained by splitting the collector laod of transistor V204 into a higher frequency part and a low frequency part. At higher frequencies, the collector load is formed by resistor R231, the other resistor R229 being bypassed by capacitor C208 and the transformed C218. At low frequencies, the load is chiefly determined by resistor R229, increasing the gain up to approximately 200 at 12 Hz. In this way, a frequency response for the combination with a lower −3dB point of 12 Hz is realized.

For a flat frequency response curve it is, of course, essential that the turn-over frequency of the clip-on current transformer and the frequency at which the gain of transistor V204 starts increasing are the same.
These frequencies are equalized by varying the value of the bypass capacitor in parallel with resistor R229.

The value of the bypass capacitor is varied with the aid of operational amplifier D201-B. The gain of this amplifier is determined by resistors R252 and R249: gain $A = -\frac{R252.}{R249}$ This means that the voltage across C218 is (A+1) times the voltage at junction R229-R231. The circuit with operational amplifier D201-B allows a capacitance variation between 1μF and 11μF. As the capacitance of this circuit is in parallel with resistor R229, potentiometer R252 allows the turn-over frequency of the amplifier to be aligned with the turn-over frequency of the clip-on current transformer.

The signal on the collector of transistor V204 is applied to emitter-follower V207. The emitter signal of V207 is available at three different levels. These levels are selected together with the input attenuator sections with the aid of the reed relays operated by the push-buttons S1A ... J.

The d.c. level at the emitter of transistor V207 is compared to earth level (point 4) in D201. The difference is fed back to the emitter of V207, via transistors V206 and V204. The phase of the feedback signal is such that any d.c. level on the emitter of V207 is compensated for: the emitter potential is maintained at 0V.

For a.c. signals, the feedback system is short-circuited by capacitor C216.

Via emitter-follower V208, the emitter signal of transistor V207 is applied to the second amplifier stage with transistor V212. The gain of this stage is 5x in positions 1 and 2 mA/DIV and 1x in the other positions. This difference in gain is accomplished by varying the emitter resistance of transistor V212 with the aid of relay K209. The x1 gain is adjusted by means of preset potentiometer R262 and the x5 gain by R264. The other networks in the emitter of V212 enable the square-wave repsonse to be optimized. Transistor V209 acts as a voltage source for the amplifier stage. Transistor V213 is the output stage with a gain of unity when the output terminates in 50 Ohm. Operational amplifier D201-C and V214 are part of a feedback system similar to the one with D201-A and V206. With the aid of the feedback system the d.c. output level is maintained at 0V.

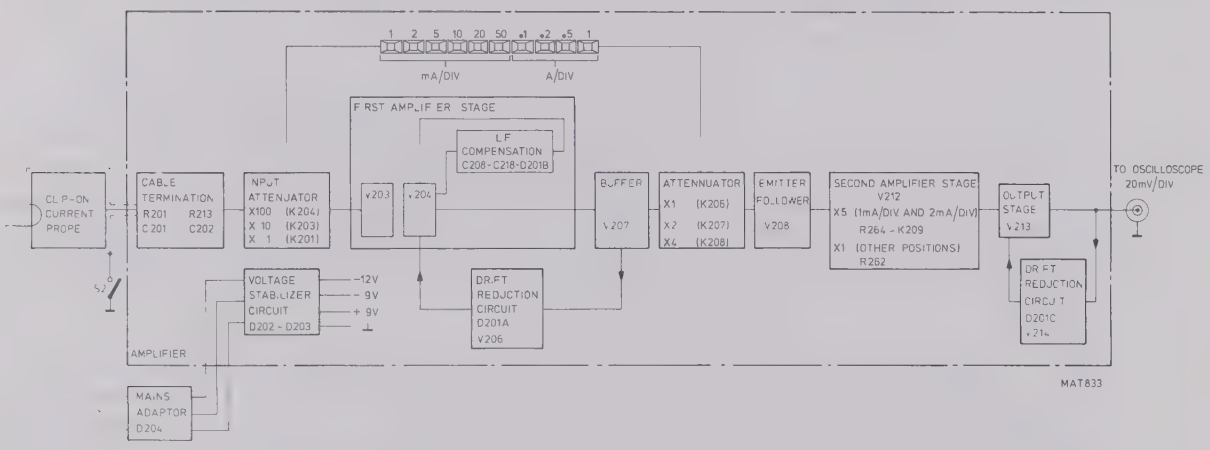


Fig. 6.1. Block diagram PM9355

7. DISMANTLING AND REPLACEMENTS

7.1. WARNING: **The opening of covers or removal of parts, except those to which access can be gained by hand, is likely to expose live parts, and also accessible terminals may be live.**
The instrument shall be disconnected from all voltage sources before any adjustment, replacement or maintenance and repair during which the instrument will be opened. If afterwards any adjustment, maintenance or repair of the opened instrument under voltage is inevitable it shall be carried out only by a skilled person who is aware of the hazard involved. Bear in mind that capacitors inside the instrument may still be charged even if the instrument has been separated from all voltage sources.

ATTENTION: **This section provides the dismantling procedures required for the removal of components during repair operations. When a circuit board is removed from the instrument, it should be adequately protected against damage, and all normal precautions regarding the use of tools must be observed. During dismantling procedures, a careful note must be made of all unsoldered leads that they may be soldered to their correct positions during assembly.**

7.2. DISMANTLING THE CLIP-ON TRANSFORMER (Fig. . 7.1.)

- Remove screw B
- Push with the screw B the nut B out of the strain relief boot A, so far that both, the screw B and the nut B can be removed with a pair of pliers
- Hold the tail piece C with one hand on its fixed position and withdraw the strain relief boot with the other hand.
- Slightly lift tail piece C and pull it out of the slider, together with the spring D.
- Pull the slider back until its securing notch at the nose of the clip-on transformer is free.
- With the aid of a knife, bend both sides of the clip-on transformer casing at points E and lift the notches at the side of the slider out of the guiding slots.
- Take the slider out of the casing; mind the movable part of the transformer core which is loose in the slider.
- Remove screw F which secures the printed-wiring board.
- Lever the stationary part of the transformer core together with the printed-wiring board out of the casing; the stationary part of the transformer core plugs into the socket on the printed-wiring board.

To reassemble the clip-on current transformer, proceed in reverse order. Before the clip-on current transformer is reassembled, **the contact areas of the transformer cores must be cleaned with a soft cloth and plain water or alcohol and not be touched again.** We recommend to clean the contact areas at regular intervals.

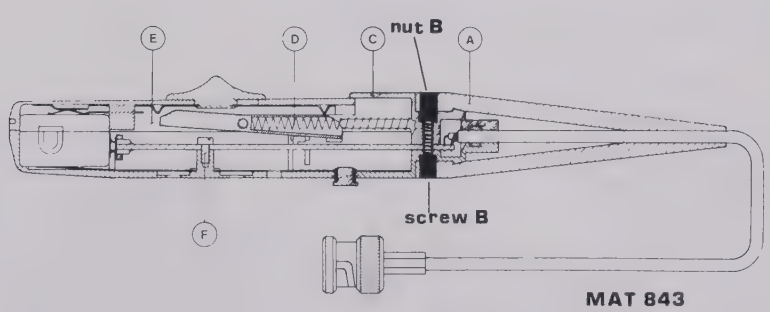


Fig. 7.1. Dismantling the clip-on current transformer

7.3. DISMANTLING THE AMPLIFIER (Fig. 7.2.)

- Remove the two screws on the rear panel of the cabinet.
- Slide the cabinet off the amplifier; all components on the printed-wiring board are then easily accessible.

7.4. REMOVING THE AMPLIFIER P.W.B. (See fig. 7.2.)

- Remove the screws C (see fig. 7.2.) which secure the p.w.b. to the front panel.
- Unsolder the capacitors C247 and C248
  (mounted between cabinet earth and circuit earth)
- Unsolder the cable connections and the BNC socket connection
- Unscrew the BNC connector
- Remove the screws B
- The p.w.b. can then be removed by moving the frame backwards
- Before the p.w.b. is refitted to the front panel, it is advisable to stick the two parts of the clamping device together by means of adhesive tape or non-hardening glue, in order to facilitate replacement, refer to fig. 7.4.

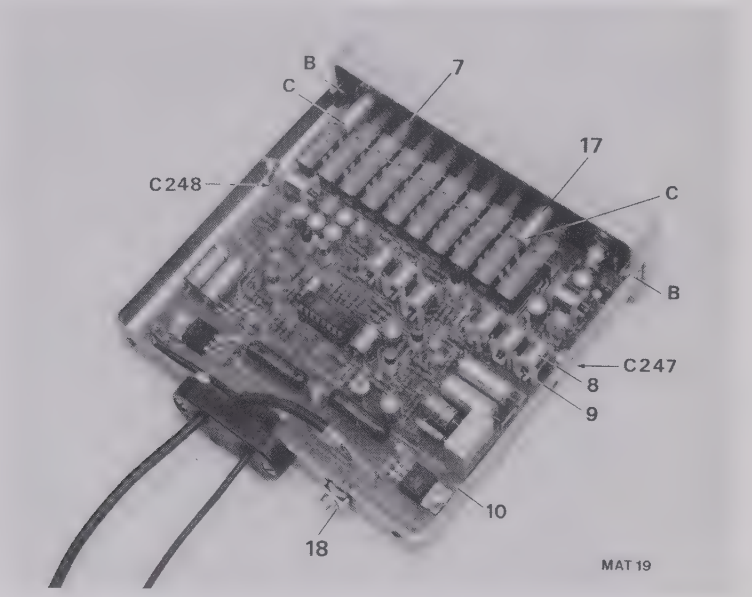


Fig. 7.2. Dismantling the amplifier

7.5. REPLACING A PUSH-BUTTON SWITCH-SEGMENT

- Remove the printed-circuit board for replacing a switch in this unit (see section 7.4.)
- Straighten the 4 retaining lugs of the relevant switch as shwon in fig. 7.3.
- Break the body of the relevant switch by means of a pair of pliers and remove the pieces. The soldering pins are then accessible.
- Remove the soldering pins and clean the holes in the printed-wiring board (e.g. with a suction soldering iron).
- Solder the new switch onto the printed-circuit board.
- Band the 4 retaining lugs back to their original positions.

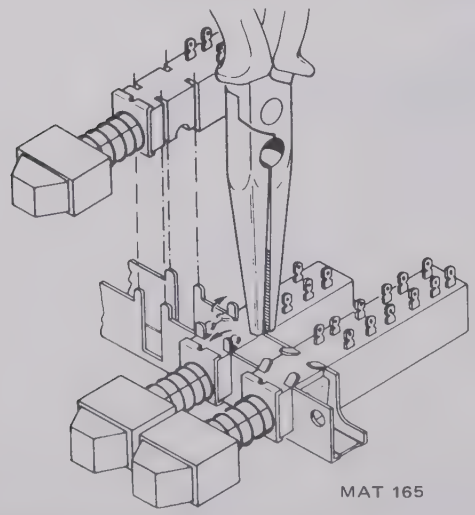


Fig. 7.3. Replacing a switch-segment of a push-button set

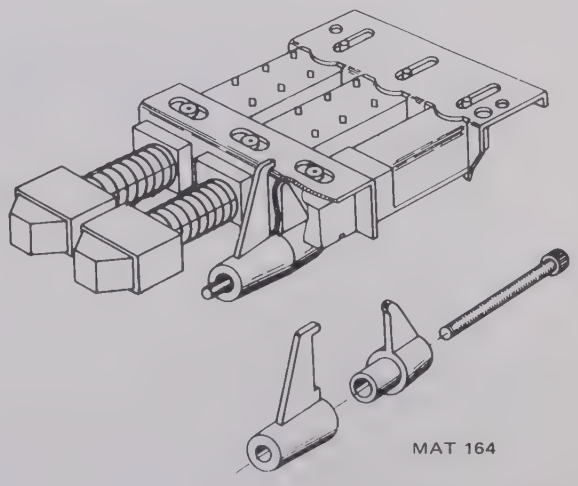


Fig. 7.4. Push-button set clamping device

7.6. STANDARD PARTS

Electrical and mechanical part replacements can be obtained through your local Philips organisation or representative. However, many of the standard electronic components can be obtained from other local suppliers. Before purchasing or ordering replacement parts, check the parts list for value tolerance, rating and description.

NOTE: Physical size and shape of a component may affect instrument performance, particularly at high frequencies. Always use direct-replacement components, unless it is known that a substitute will not degrade instrument performance.

7.7. RECALIBRATION AFTER REPAIR

After any electrical component has been replaced the calibration of that particular circuit should be checked, as well as the calibration of other closely related circuits.
Since the power supply affects all circuits, calibration of the entire instrument should be checked if work has been done in the power supply.

7.8. REPLACING A REED-RELAY CONTACT

Starting with the instrument DQ 1825 the reed relay contact tubes are soldered on two wires, (length 6 mm) which are soldered vertical on the amplifier p.w.b. They are mounted in this way to prevent that the glass tube breaks when its connection-wires are bent for mounting on the amplifier p.w.b.
For replacing, take care of the following:

- Cut the connection wires of the reed-relay contact at a length of 4 mm.
- Slide the glass tube carefully in the relay coil.
- To prevent that the glass tube will be damaged when it is soldered on the two vertical wires, the distance between the soldering-point and the glass tube must be minimum **3 mm** (isolation tube).
- The soldering-time must be not longer than **5 seconds** at a temperature of maximum **260°C.**

7.9. INSTRUMENT REPACKAGING

If the instrument is to be shipped to a service Centre for service or repair, attach a tag showing owner (with address) and the name of an individual at your firm that can be contacted. The Service Centre needs the complete instrument serial number and a fault description.
Save and re-use the packing in which you instrument was shipped. If the original packing is unfit for use or not available, repack the instrument in such a way that no damage during transport occurs.

8. CHECKING AND ADJUSTING

8.1. GENERAL INFORMATION

The following information provides the complete checking and adjusting procedure for the current probe. As various control functions are interdependent, a certain order of adjustment is often necessary.
The procedure is, therefore, presented in a sequence which is best suited to this order, cross-reference being made to any circuit which may affect a particular adjustment.
Before any check or adjustment, the instrument must attain its normal operating temperature.

- Where possible, instrument performance is checked before an adjustment is made.
- Warming-up time under average conditions is 30 minutes.
- All limits and tolerances given in this section are calibration guides and should not be interpreted as instrument specifications unless they are also published in chapter 2. Characteristics.
- Tolerances given are for the instrument under test and do not include test equipment error.
- The most accurate display adjustments are made with a stable, will-focused, low-intensity display. Unless otherwise noted, adjust the Intensity, Astigmatism, Focus, and Trigger Level controls as needed.

8.2. RECOMMENDED TEST EQUIPMENT

Recommended instrument	Required specifications	Example of recommended instrument
Oscilloscope	100MHz (only for the bandwith check) 50 MHz	PM 3262 PM 3240
Function generator	100Hz - 250kHz square wave signal $0{,}3V_{pp}$ - $15V_{pp}$ duty cycle 50% rise time $<$ 70 ns	PM 5127
Square-wave generator	100kHz - 500 kHz rise time 1ns amplitude $1V_{pp}$ - $10V_{pp}$	HP 8000A HEWLETT PACKARD
Sine-wave generator	50kHz reference frequency 250kHz - 100 MHZ sine-wave signal constant amplitude of $0{,}3V_{pp}$ - $1{,}5V_{pp}$	TEKTRONIX SG 503
Adaptor General Radio-BNC BNC T-piece		PM 9064 PM 9607
Termination pad	50Ω(supplied with the instrument)	PM 9585
Calibration fixture		TEKTRONIX 067 - 0559 - 00

The current probe is adjusted in the following sequence:

1. The clip-on current transformer only (section 8.3.)
2. The combination clip-on current transformer and amplifier (section 8.4.)

NOTE: Always use the current probe with the same 50-Ohm-feedthrough termination pad (PM 9585).

8.3. ADJUSTING THE CLIP-ON CURRENT TRANSFORMER

In the interest of brevity, we shall use the term PROBE instead of clip-on current transformer throughout the entire checking and adjusting procedure.

8.3.1. Checking the transformation ratio (99:1)

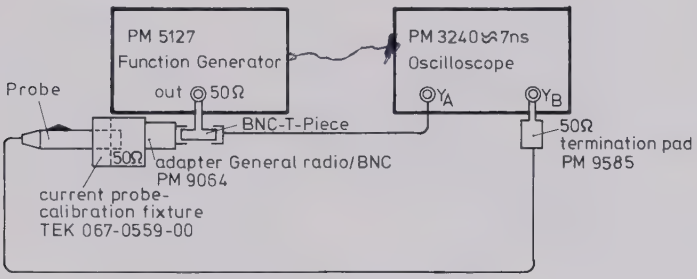
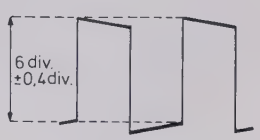


Fig. 8.1. Measuring set-up for probe.



Mat 30

Fig. 8.2.

- Use measuring set-up according to fig. 8.1.
- Set output of generator to 10kHz, square wave signal
- Set oscilloscope to 0.5V/DIV (YA) and adjust to 6 DIV by means of the generator
- Set YB to 5mV/DIV and check that signal is according to fig. 8.2.

8.3.2. L.F. Check

- Use measuring set-up according to fig. 8.1.
- Set output of generator to 100kHz~
- Set YB to 20mV/DIV and adjust to 5DIV with generator (channel A not used)
- Decrease frequency until YB gives a trace height of 3.5 DIV.
- Check that frequency at this point (–3dB) is ⩽ 450Hz

8.3.3. H.F. ADJUSTMENT

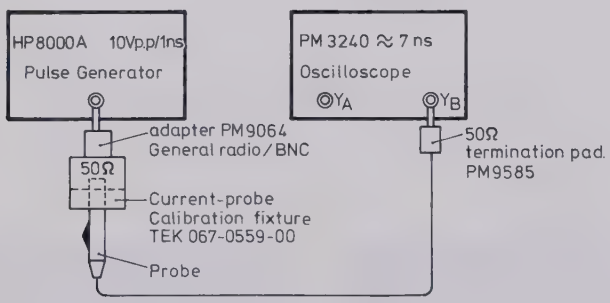
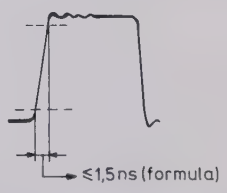


Fig. 8.3. Measuring set-up



Mat 31

Fig. 8.4.

- Use measuring set-up according to fig. 8.3.
- Set pulse generator to $10V_{p\text{-}p}$ (100kHz, square wave signal).
- Set YB to 20mV/DIV
- Adjust to optimum pulse (fig. 8.4.) with trimmer potentiometers R1 and R2 and trimmer capacitor C1 (fig. 4.1.). Use the corraction formula t_r probe = $\sqrt{(t_r^2 \text{ screen} - t_r^2 \text{ scope})}$.

8.4. CHECKING AND ADJUSTING THE PROBE AND AMPLIFIER COMBINATION (Fig. 9.3.)

Unless otherwise stated, the controls always occupy the same position as in the previous check.

8.4.1. Deflection coefficients

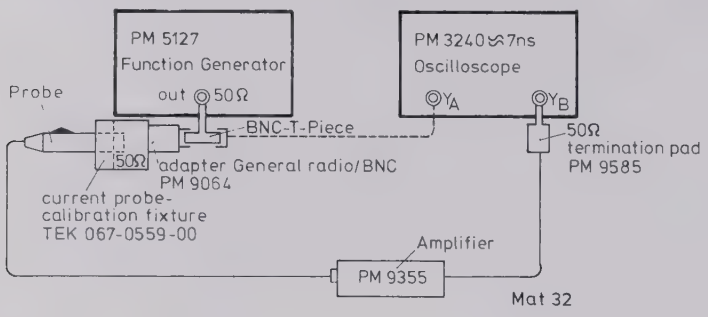


Fig. 8.5.

- Use measuring set-up according to fig. 8.5.(without YA)
- No amplifier pushbuttons depressed
- Set YB of oscilloscope to 20mV/DIV.
- Set the input coupling switch of the oscilloscope to 0
- Set the oscilloscope to automatic triggering.
- Centre the time-base line by means of the POSITION potentiometers
- Set the input coupling switch of the oscilloscope to DC
- Depress the 5mA/DIV push-button on the amplifier
- Check that the time-base line is still in the centre of the oscilloscope screen; tolerance + or −¼ DIV.
- Apply a symmetrical square-wave current of $30mA_{p-p}$, frequency 10kHz, mark-space ratio 50% to the probe ($1.5V_{p-p}$ across 50 Ohm). Use measuring set-up from fig. 8.5. with YA as reference at 3 DIV.
- Check that the trace height on YB is 6 DIV; if necessary, readjust preset potentiometer R262.
- Check the deflection coefficients 10mA/DIV and 20mA/DIV using suitable current values; tolerance + or −3%
- Depress the 50mA/DIV push-button on the amplifier
- Increase the input current to $300mA_{p-p}$ ($15\ V_{pp}$ across 50 Ohm)
- Check that the trace height is 6 DIV; if necessary, readjust preset potentiometer R202
- Depress the 1mA/DIV push-button on the amplifier
- Decrease the input current to $6mA_{p-p}$ ($0,3V_{pp}$ across 50 Ohm)
- Check that the trace height is 6 DIV; if necessary, readjust preset potentiometer R264
- Depress the 0,5 A/DIV push-button on the amplifier
- Increase the input current to $300mA_{p-p}$ ($15V_{pp}$ across 50 Ohm)
- Set the Y deflection coefficient of YB to 5mV/DIV.
- Check that the trace height is 2,4 DIV + or −3%

8.4.2. L.F. Adjustment

- Use measuring set-up according to fig. 8.5. (with YA as reference)
- Set the Y deflection coefficient of channel B to 20mV/DIV.
- Depress the 50mA/DIV push-button on the amplifier
- Apply a square-wave current of $300mA_{p-p}$, frequency 100Hz, to the probe. ($15V_{p-p}$ across 50 Ohm)
- Check that the top of the displayed pulse is straight; if necessary, readjust preset potentiometer R252 (fig. 8.7.)
- Decrease the input current to $30mA_{p-p}$

- Depress the 5mA/DIV push-button on the amplifier
- Check that the top of the displayed pulse is straight; if necessary, readjust preset potentiometer R222 (fig. 8.7.)
- Apply a sine-wave current of 30mA$_{p-p}$, frequency 1kHz, to the probe. The trace height is 6 DIV.
- Lower the frequency of the input current until the trace height is 4.2 DIV.
- Check that the frequency of the input current is $\leqslant$ 12Hz.

8.4.3. H.F. Adjustment

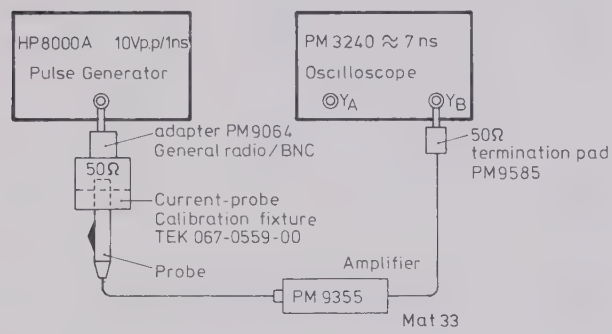


Fig. 8.6.

- Use measuring set-up according to fig. 8.6.
- Depress the 5mA/DIV push-button on the amplifier
- Apply a square-wave current of 20mA$_{p-p}$ (4 DIV), rise time 1 ns, to the probe.
- Check the pulse response; if necessary, readjust preset potentiometers R221 and R263 and trimmer capacitor C224.
- Check that the rise time of the amplifier/probe combination is $\leqslant$ 5ns (use the correction formala t_r combination = $\sqrt{(t_r{}^2 \text{ screen} - t_r{}^2 \text{ scope})}$. If necessary, repeat adjustment of chapter 8.3.3.
- Depress the 50mA/DIV push-button on the amplifier
- Increase the value of the input curent to 300mA$_{p-p}$ (15V$_{pp}$ across 50 Ohm)
- Check the pulse response; if necessary, readjust trimmer capacitor C203 for optimum square-wave response.
- Depress the 0.5 A/DIV push-button on the amplifier.
- Set the Y deflection coefficient of the oscilloscope to 5mV/DIV (2,4 DIV Y-deflection)
- Check the pulse response; if necessary, readjust preset potentiometer R211 for optimum square-wave response.
- Apply a square-wave current of 4mA$_{p-p}$, rise time 1 ns, to the probe.
- Depress the 1mA/DIV push-button on the amplifier.
- Set the Y deflection coefficient of the oscilloscope to 20mV/DIV.
- Check the square-wave response; if necessary, readjust preset potentiometer R266 and trimmer capacitor C227
- Check that the rise time of the amplifier/probe combination is $\leqslant$ 8 ns (use correction formula).

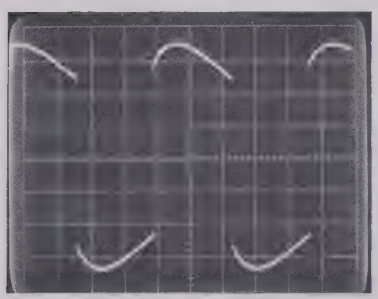


Fig. 8.7.1. Under-compensated.

Fig. 8.7.2. Correctly adjusted

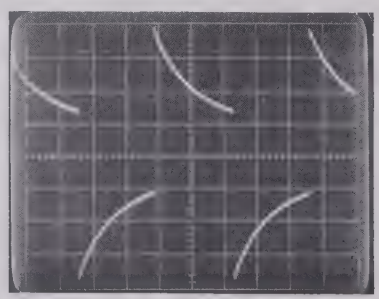


Fig. 8.7.3. Over-compensated

Fig. 8.7. LF Adjustment

8.4.4. Bandwidth check

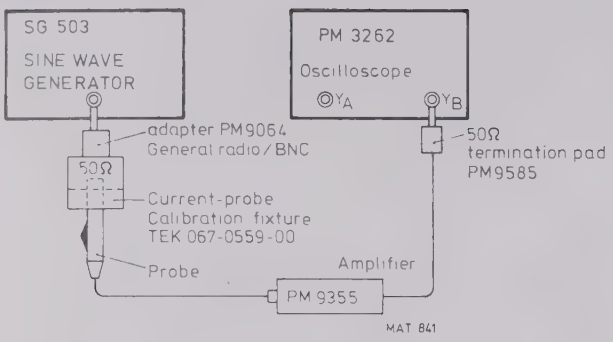


Fig. 8.8.

- Use measuring set-up according to fig. 8.8
- Depress the 5 mA/DIV. push-button on the amplifier
- Set the oscilloscope to 20 mV/DIV
- Apply a 50 kHz sine-wave signal to the probe
- Adjust the amplitude of the sine-wave signal so that the vertical deflection on the oscilloscope is 6 DIV. ($1{,}5V_{pp}$ across $50\,\Omega$)
- Increase the input frequency until the trace height is 4,2 DIV.
- Check that the frequency of the input current is $\geqslant$ 70 MHZ
- Set the frequency of the input current to 50 kHz
- Depress the 2mA/DIV push-button on the amplifier
- Adjust the amplitude of the input current to 6 DIV vertical deflection ($0{,}6V_{pp}$ across $50\,\Omega$)
- Increase the input frequency until the trace height is 4,2 DIV.
- Check that the frequency of the input current is $\geqslant$ 45 MHZ
- Set the frequency of the input current to 50 kHz
- Depress the 1 mA/DIV push-button on the amplifier
- Adjust the amplitude of the input current ot 6 DIV vertical deflection ($0{,}3V_{pp}$ across 50 Ω)
- Increase the input frequency until the trace height is 4,2 DIV.
- Check that the frequency of the input current is $\geqslant$ 45 MHZ

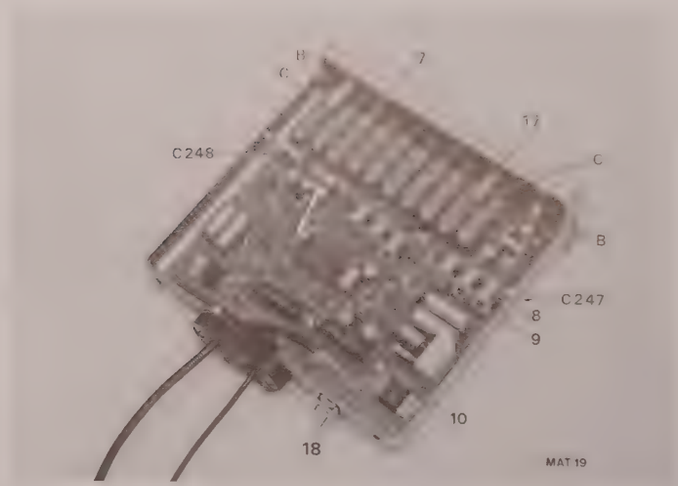
9. PARTS LIST AND DIAGRAMS

(Subject to alteration without notice)

9.1. MECHANICAL PARTS

Item	*Fig.*	*Qty per unit*	*Order number*	*Description*
1	9.1	1	5322 447 64014	Cover with slider
2	9.1.	1	5322 142 74006	Moving part of core
3	9.1	1	5322 142 74005	Stationary part of core
4	9.1	1	5322 216 94107	Printed-wiring board in probe
5	9.1	1	5322 447 64013	Housing complete
6	9.1	1	5322 325 54066	Strain relief boot
6	9.1	1	5322 321 24555	Cable with BNC
7	9.2	1	5322 276 84041	Push-button switch unit complete
		10	5322 276 14101	Single push-button switch segment
		1	5322 466 85843	Support for max. 11 switches (must be sawn on required size)
8	9.2.	8	5322 280 24076	Reed relay coil 6V
9	9.2	8	5322 280 24126	Reed relay contact
10	9.2	1	5322 216 94201	Printed-wiring board in amplifier
11	9.2	1	5322 447 64023	Amplifier cabinet
12	9.2	1	5322 459 24046	Ornamental frame
13	9.2	1	5322 456 94077	Text plate
14	9.2	1	5322 267 10004	B.N.C.
15	9.2	1	5322 693 84001	Mains adaptor [Europe]
		1	5322 693 84002	Mains adaptor [U.S.A.]
16	9.2	1	5322 320 14026	Output cable complete
17	9.2.	2	5322 405 94175	Male clamping piece
17	9.2.	2	5322 405 94176	Female clamping piece
17	9.2	2	4822 502 11142	Screw for clamping pieces
18	9.2	1	5322 405 94046	Earth clip
		2	5322 325 64085	Fulle (mounted in amplifier-frame for the output cables)

Fig. 9.1. Clip-on current transformer with item number indication



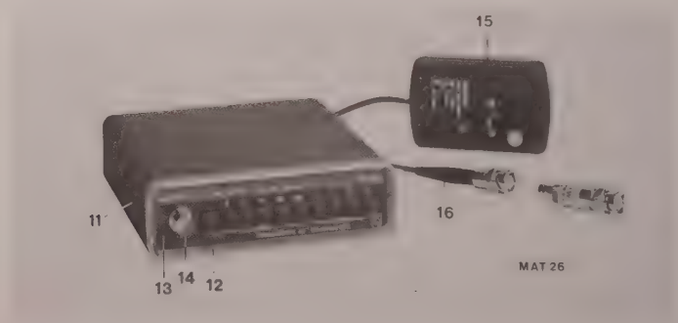


Fig. 9.2. Amplifier with item number indication

9.2. ELECTRICAL PARTS

ITEM	ORDERING NUMBER	FARAD	TOL (%)	VOLTS	REMARKS
CAPACITORS					
C1	5322 125 54079	6,5-40P			TRIMMER
C126	4822 122 31054	10PF	2%		CERAMIC PLATE
C 201	4822 122 31058	15PF	2	100	CERAMIC PLATE
C 202	4822 122 31072	47PF	2	100	CERAMIC PLATE
C 203	5322 125 50051	18 PF		300	TRIMMER
C 204	4822 122 30034	470PF	10	100	CERAMIC PLATE
C 205	4822 122 30043	10NF	-20+80	40	CERAMIC PLATE
C206	5322 124 14054	330UF	10%	6V .	ELECTROLYTIC TANTALUM
C207	5322 124 14054	330UF	10%	6V .	ELECTROLYTIC TANTALUM
C208	5322 124 24267	1,5UF -		63V.	ELECTROLYTIC
C 209	4822 122 30103	22NF	0	40	CERAMIC PLATE
C211	4822 124 20672	150UF -	10+50%	6,3V	ELECTROLYTIC
C 213	4822 122 31052	8,2PF	0,25PF	100	CERAMIC PLATE
C 214	4822 122 30043	10NF	-20+80	40	CERAMIC PLATE
C216	4822 124 20672	150UF -	10+50%	6,3V	ELECTROLYTIC
C 217	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C 218	5322 121 40197	1 µF	10%	100	POLYESTER FOIL
C 219	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C 221	4822 122 30055	330PF	10	100	CERAMIC PLATE
C 222	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C 223	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C 224	5322 125 50051				TRIMMER
C 226	4822 122 31061	18PF	2	100	CERAMIC PLATE
C 227	5322 125 50051	18 PF		300	TRIMMER
C 229	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C 231	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C232	4822 124 20698	22 UF -	10+50%	25V.	ELECTROLYTIC
C 233	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C 234	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C 236	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C237	4822 124 20701	100UF -	10+50%	25V.	ELECTROLYTIC
C 238	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C 239	4822 122 30103	22NF	-20+80	40	CERAMIC PLATE
C241	4822 124 20701	100UF -	10+50%	25V.	ELECTROLYTIC
C 242	4822 121 40427	220 NF	10%	100V	POLYESTER FOIL
C 243	4822 121 40427	220 NF	10%	100V	POLYESTER FOIL
C247	4822 122 30103	22 NF -	20+80%	40V.	CERAMIC PLATE
C248	4822 122 30103	22 NF -	20+80%	40V.	CERAMIC PLATE

ITEM	ORDERING NUMBER	OHM	TOL (%)	TYPE	REMARKS
RESISTORS					
R 1	5322 100 10143	1K	20	0.75W	TRIMMING POTM
R 2	5322 100 10143	1K	20	0.75W	TRIMMING POTM
R 126	4822 111 30245	47	5	CR16	CARBON
R 127	4822 111 30245	47	5	CR16	CARBON
R 201	5322 116 54441	49,9	1	MR25	METAL FILM
R 202	5322 100 10133	220	20	0.75W	TRIMMING POTM
R 203	5322 111 44174	11	5	0,25W	CARBON
R 204	5322 111 44175	10	5	0,25W	CARBON
R 206	5322 116 50818	44,2	1	MR25	METAL FILM
R 207	5322 116 50818	44,2	1	MR25	METAL FILM
R 209	5322 116 55451	487	1	MR25	METAL FILM
R 211	5322 100 10135	470	20	0.75W	TRIMMING POTM
R 212	5322 116 50926	40,2	1	MR25	METAL FILM
R 213	5322 116 50818	44,2	1	MR25	METAL FILM
R 214	5322 116 50459	422	1	MR25	METAL FILM
R 216	5322 116 50459	422	1	MR25	METAL FILM
R 217	5322 116 50592	442	1	MR25	METAL FILM
R 218	5322 116 55367	3,48K	1	MR25	METAL FILM
R 219	5322 116 50766	147	1	MR25	METAL FILM
R 221	5322 100 10143	1K	20	0.75W	TRIMMING POTM
R 222	5322 100 10139	4,7K	20	0.75W	TRIMMING POTM
R 223	4822 116 51235	1K	1	MR25	METAL FILM
R 224	4822 116 51232	619	1	MR25	METAL FILM
R 226	5322 116 50527	33,2	1	MR25	METAL FILM
R 227	5322 116 55361	16,2K	1	MR25	METAL FILM
R 229	5322 116 54567	1,69K	1	MR25	METAL FILM
R 231	5322 116 50506	154	1	MR25	METAL FILM
R 232	5322 116 50527	33,2	1	MR25	METAL FILM
R 233	5322 116 50511	48,7	1	MR25	METAL FILM
R 234	4822 116 51235	1K	1	MR25	METAL FILM
R 236	5322 116 54469	100	1	MR25	METAL FILM
R 237	5322 116 54576	2,37K	1	MR25	METAL FILM
R 238	5322 116 54441	49,9	1	MR25	METAL FILM

ITEM	ORDERING NUMBER	OHM	TOL (%)	TYPE	REMARKS
R 239	5322 116 54261	12,7	1	MR25	METAL FILM
R 241	5322 116 54441	49,9	1	MR25	METAL FILM
R 242	5322 116 54442	51,1	1	MR25	METAL FILM
R 243	5322 116 55445	4,87K	1	MR25	METAL FILM
R 244	5322 116 55368	383	1	MR25	METAL FILM
R 246	5322 116 54576	2,37K	1	MR25	METAL FILM
R 247	5322 116 50561	590	1	MR25	METAL FILM
R 248	5322 116 54632	14,7K	1	MR25	METAL FILM
R 249	5322 116 50523	4,99K	1	MR25	METAL FILM
R 251	5322 116 50523	4,99K	1	MR25	METAL FILM
R 252	5322 100 10142	100K	20	0.75W	TRIMMING POTM
R 253	5322 116 54557	1,21K	1	MR25	METAL FILM
R 254	5322 116 55368	383	1	MR25	METAL FILM
R 256	5322 116 54469	100	1	MR25	METAL FILM
R 257	5322 116 50527	33,2	1	MR25	METAL FILM
R 258	4822 116 51281	5,62K	1	MR25	METAL FILM
R 259	5322 116 50767	2,15K	1	MR25	METAL FILM
R 261	5322 116 50484	4,64K	1	MR25	METAL FILM
R 262	5322 100 10143	1K	20	0.75W	TRIMMING POTM
R 263	5322 100 10133	220	20	0.75W	TRIMMING POTM
R 264	5322 100 10133	220	20	0.75W	TRIMMING POTM
R 266	5322 100 10143	1K	20	0.75W	TRIMMING POTM
R 268	5322 116 55426	6,19K	1	MR25	METAL FILM
R 269	5322 116 55366	301	1	MR25	METAL FILM
R 271	5322 116 50527	33,2	1	MR25	METAL FILM
R 272	5322 116 55278	909	1	MR25	METAL FILM
R 273	5322 116 50418	17,8	1	MR25	METAL FILM
R 274	5322 116 54469	100	1	MR25	METAL FILM
R 276	5322 116 50527	33,2	1	MR25	METAL FILM
R 277	5322 116 50579	3,16K	1	MR25	METAL FILM
R 278	5322 116 55368	383	1	MR25	METAL FILM
R 279	5322 116 54576	2,37K	1	MR25	METAL FILM
R 280	5322 116 54442	51,1	1	MR25	METAL FILM
R 281	5322 116 54576	2,37K	1	MR25	METAL FILM
R 282	4822 116 51267	75K	1	MR25	METAL FILM
R 283	5322 116 55365	205	1	MR25	METAL FILM
R 284	5322 116 54489	169	1	MR25	METAL FILM
R 286	5322 116 50568	4,99	1	MR25	METAL FILM
R 287	5322 116 50568	4,99	1	MR25	METAL FILM
R 288	4822 112 41107	1K	5	7W	WIRE-WOUND
R 289	4822 112 41116	2,2K	5	7W	WIRE-WOUND

ITEM	ORDERING NUMBER	TYPE/DESCRIPTION
SEMI CONDUCTORS		
V 201	4822 130 30613	BAW62
V 202	4822 130 30613	BAW62
V 203	4822 130 44154	BF173
V 204	4822 130 41448	BF324
V 206	4822 130 40964	BC549
V 207	4822 130 44196	BC548C
V 208	4822 130 40493	BFY90
V 209	5322 130 40373	BCY71
V 211	4822 130 34173	BZX79-C5V6
V 212	4822 130 41448	BF324
V 213	4822 130 40493	BFY90
V 214	5322 130 40373	BCY71
V 216	4822 130 30862	BZX79-C9V1
V 217	4822 130 30862	BZX79-C9V1
INTEGRATED CIRCUITS		
D 201	5322 209 84386	TCA220
D 202	5322 209 85769	79M12CU
D 203	5322 209 86227	78M12CU
MISCELLANEOUS		
L 126	5322 158 14127	SAM SPOEL
L 127	5322 158 14127	SAM SPOEL
L 128	5322 158 14129	SAM SPOEL
L 129	5322 158 14128	SAM SPOEL
L201	5322 158 10243	100UH
L202	5322 158 10243	100UH
L 203/R208	5322 158 14216	Coil Assy

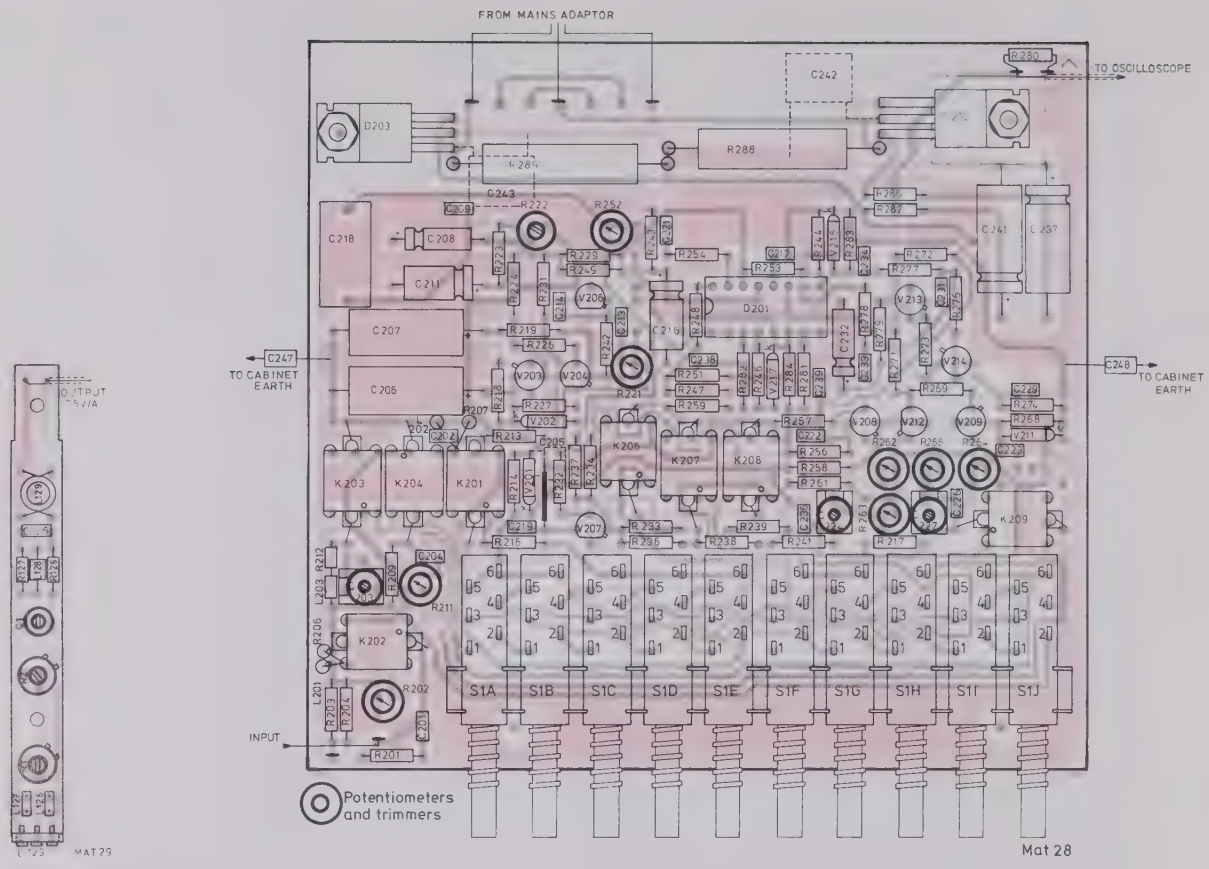


Fig. 9.3. Printed-wiring boards of clip-on current transformer and amplifier with indication of adjusting elements.

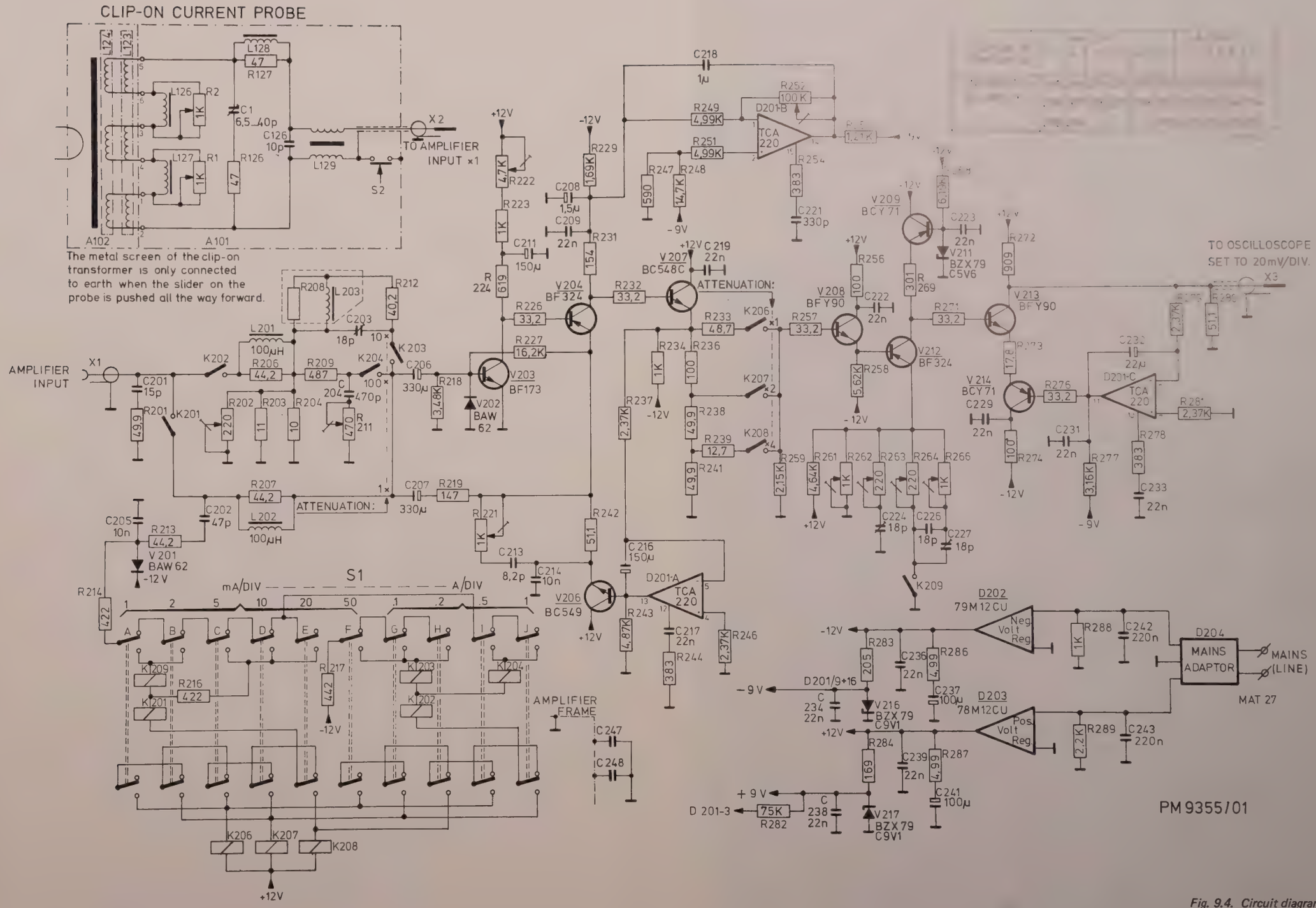


Fig. 9.4. Circuit diagram

CODING SYSTEM OF FAILURE REPORTING FOR QUALITY ASSESSMENT OF T & M INSTRUMENTS

(excl. potentiometric recorders)

The information contents of the coded failure description is necessary for our computerized processing of quality data.

Since the reporting of repair and maintenance routines must be complete and exact, we give you an example of a correctly filled-out PHILIPS SERVICE Job sheet.

① Country	② Day Month Year	③ Typenumber /Version	④ Factory/Serial no.
32	150475	OPM 3260 02	DO 00783

CODED FAILURE DESCRIPTION ⑥

⑤ Nature of call	Location	Component/sequence no.	Category
☐ Installation		TS0607	5
☐ Pre sale repair		R00631	2
☐ Preventive maintenance	0021	990001	4
☒ Corrective maintenance			
☐ Other			

⑦ *Job completed* ☒

Working time ⑧ 12 Hrs

Detailed description of the information to be entered in the various boxes:

①Country: 32 = Switzerland

②Day Month Year 150475 = 15 April 1975

③Type number/Version OPM3260 02 = Oscilloscope PM 3260, version 02 (in later oscilloscopes this number is placed in front of the serial no)

④Factory/Serial number DO 0078 3 = DO 783 These data are mentioned on the type plate of the instrument

⑤ Nature of call: Enter a cross in the relevant box

⑥ Coded failure description

Location

☐☐☐☐

These four boxes are used to isolate the problem area. Write the code of the part in which the fault occurs, e.g. unit no or mechanical item no of this part (refer to 'PARTS LISTS' in the manual).

Example: 0001 for Unit 1
000A for Unit A
0075 for item 75

If units are not numbered, do not fill in the four boxes; see Example Job sheet.

Component/sequence no.

☐☐☐☐☐☐

These six boxes are intended to pinpoint the faulty component.

A. Enter the component designation as used in the circuit diagram. If the designation is alfa-numeric,the letters must be written (starting from the left) in the two left-hand boxes and the figures must be written (in such a way that the last digit occupies the right-most box) in the four right-hand boxes.

B. Parts not identified in the circuit diagram:

990000 Unknown/Not applicable
990001 Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
990002 Knob (incl. dial knob, cap, etc.)
990003 Probe (only if attached to instrument)
990004 Leads and associated plugs
990005 Holder (valve,transistor, fuse, board, etc.)
990006 Complete unit (p.w. board, h.t. unit, etc.)
990007 Accessory (only those without type number)
990008 Documentation (manual, supplement, etc.)
990009 Foreign object
990099 Miscellaneous

Category

☐

0 Unknown, not applicable (fault not present, intermittent or disappeared)
1 Software error
2 Readjustment
3 Electrical repair (wiring, solder joint, etc.)
4 Mechanical repair (polishing, filing, remachining, etc.)
5 Replacement (of transistor, resistor, etc.)
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

⑦ Job completed: Enter a cross when the job has been completed.

⑧ Working time: Enter the total number of working hours spent in connection with the job (excluding travelling, waiting time, etc.), using the last box for tenths of hours.

12 = 1,2 working hours (1 h 12 min.)

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